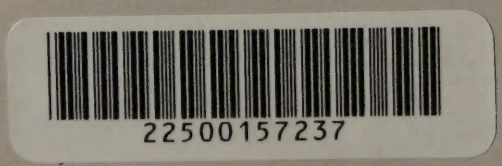
SUPPLEMENT TO INTERSERVICE MANUAL ON PEST CONTROL

DEFENCE RESEARCH BOARD
DEPARTMENT OF NATIONAL DEFENCE
CANADA

DECEMBER, 1957



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DEPARTMENT OF NATIONAL DEFENCE
CANADA

DIRECTORATE OF PERSONNEL RESEARCH
ENVIRONMENTAL PROTECTION

SUPPLEMENT TO INTERSERVICE MANUAL ON PEST CONTROL

Published December, 1957
OTTAWA

7-172

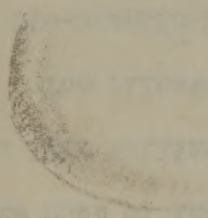
Preface

This account of insect identification was prepared by officers of the Entomology Division, Science Service, Canada Department of Agriculture, as a supplement to the Interservice Manual on Pest Control published in July 1956 by the Defence Research Board of the Department of National Defence, Ottawa. It is not intended to be a guide to all pest species of insects and other arthropods in Canada, but considers mainly the species and groups covered in the Manual.

Keys to the various groups on insects and other arthropods were prepared by officers of the Insect Systematics and Biological Control Unit at Ottawa. J.F. McAlpine planned and organized the section and wrote much of the general account. The final assembly was done by Miss H.R. Hollinsworth.

The illustrations were photo-copied from various standard works by the Bio-Graphic Unit, Science Service, under the direction of G.H. Parker.

G.P. Holland
Head, Insect Systematics and Biological Control Unit



SUPPLEMENT TO INTERSERVICE MANUAL ON

PEST CONTROL

IDENTIFICATION OF PESTS

CONTENTS

IDENTIFICATION OF PESTS

INTRODUCTION

This section is designed primarily for workers who have not had formal training in the study of insects. It is not meant to be a comprehensive treatment of the subject and the user is advised from the outset that, entomologically speaking, its scope and usefulness is limited. The main purposes and aims are: (i) to acquaint the user with a few basic facts about entomology and to provide him with some fundamental directions on collecting, preparing, and identifying insects, and (ii) to help him to identify a few of the commoner species of insect pests, or suspected pests, and to place others in their orders, families and genera.

The following list of general entomological textbooks is offered for those who may be interested in pursuing the subject further. In addition to providing a great deal of general information on many insects, each will serve as a starting point for references to more specialized literature on the various aspects of entomology.

1. Borror, D.J., and D.M. DeLong. 1954. An Introduction to the Study of Insects. 1030 pp. Rinehart and Co., New York.
2. Brues, C.T., and A.L. Melander. 1932, 1945. Classification of Insects. Bull. Mus. Comp. Zool. Vol. 73. 672 pp. Harvard College Press.
3. Brues, C.T., A.L. Melander, and F.M. Carpenter. 1954. Classification of Insects. Bull. Mus. Comp. Zool. Vol. 108. 917 pp. Harvard College Press.
4. Comstock, J.H. 1924, 1933. An Introduction to Entomology. 1044 pp. Comstock Pub. Co., Ithaca, N.Y.

5. Essig, E.O. 1942. College Entomology. 900 pp. MacMillan Pub. Co., New York.

6. Frost, S.W. 1942. General Entomology. 524 pp. McGraw-Hill Book Co., New York and London.

7. Imms, A.D. 1926, 1930, 1934. A General Textbook of Entomology. 720 pp. E.P. Dutton, New York, and Methuen and Co. London.

8. Metcalfe, C.L., W.P. Flint and R.L. Metcalfe. 1928, 1939, 1951. Destructive and Useful Insects. 981 pp. McGraw-Hill Book Co., New York.

9. Ross, H.H. 1948. Textbook of Entomology. 532 pp. Wiley and Sons, New York, and Chapman and Hall, London.

For an elementary book on general entomology, written in non-technical language and a semi-popular style, consult: Urquhart, F.A. 1949. Introducing the Insect. 287 pp. Clark Irwin and Co., Toronto.

For a comprehensive treatment of the biology and control of many insect pests of medical and general importance consult: Busvine, J.R. 1951. Insects and Hygiene. 482 pp. Methuen and Co. Ltd. London.

Numbers of Insects

Group	Common Names	Approximate number of species*
Insecta.....	Insects.....	640,000
Other Arthropoda	Spiders, centipedes, crawfish, etc...	73,500
Mollusca.....	Clams and other shellfish, snails....	80,000
Chordata.....	Mammals, birds, fish, reptiles, etc..	60,000
All other animals	Sponges, corals, worms, etc.....	62,500
Total.....		916,000

*Estimate by Metcalfe and Flint (1939, 1951)

Insects are the most successful group of living things on earth. There are about three times as many different kinds in this single group, as there are kinds of all other animals combined. In other words, about three-fourths of all known animal species are insects. When we include them with other arthropods such as spiders, ticks, mites, and centipedes, there are about 713,500 different species known to science.

In the Nearctic Region (the part of North America lying north of Mexico) the insect fauna includes representatives of about 30 orders, 500 families, some 12,000 genera, and an estimated 125,000 to 150,000 species. Over 80,000 species are estimated to occur in Canada alone. By comparison, there are only about 32,000 species of mammals in the entire world.

It should not be assumed that all insects are pests. Indeed, the number of harmful species is relatively small. In addition to those that are injurious there are many that are beneficial to man, but by far the largest number do not appear to affect human welfare one way or the other.

The System of Classification

Insects, like books in a library, are divided into large groups that are redivided into progressively smaller groups. They all belong to the class Insecta -- one of the many classes of the great phylum Arthropoda which includes all invertebrate animals with jointed legs. Different groups of insects, such as butterflies, ants, beetles, and many others belong to different orders. The orders are composed of families and the families, in turn, are composed of genera. Each genus contains one or more of the basic units of the whole hierarchy of taxonomic categories -- the species. Thus the common house fly, scientifically

known as Musca domestica L., belongs to:

Kingdom Animalia (animals)

Phylum Arthropoda (joint-legged invertebrates -- arthropods)

Class Insecta (six-legged arthropods -- insects)

Order Diptera (two-winged insects -- true flies)

Family Muscidae (muscids)

Genus Musca

Species domestica L.

The "L." following the specific name is the initial of the author who first named and described the species. In this case the author is Linnaeus, the Swedish naturalist who, in 1758, proposed the system of classification now used for all animals.

Some Characteristics of an Insect

Insects are distinguished from other arthropods by having six legs in the adult stage. The body consists of three regions, i.e., head, thorax, and abdomen. The head bears eyes, one pair of antennae, and mouth-parts. The thorax consists of three segments, each bearing a pair of legs; in many groups the second and third segments each bears a pair of wings. The third region, the abdomen, is comprised of as many as 11 segments and has no legs; the eighth and ninth segments usually have appendages modified for mating and egg-laying.

Immature Stages and Development

With few exceptions all insects lay eggs. When the young insect emerges from the egg, it may look very much like the adult except for its smaller size and wingless condition. This is true of grasshoppers, for example (Fig. 3). Their young, and the young of many other forms

that grow in a similar gradual fashion, are called nymphs because they resemble their parents. As they grow, nymphs periodically moult, or cast their skins, and pass into the next instar or stage; after the final they take on all the characteristics of the adult.

Most insects, however, pass through three very dissimilar stages, namely egg, larva, and pupa, before reaching the adult stage. Often, none of the immature stages bear even a remote resemblance to the adult stage. This is true of butterflies, moths (Fig. 4), flies (Fig. 5), and many other insects.

Importance of Correct Identification

The scientific name of an insect is the key to the information recorded for that species. Therefore, it is very important that the right name be applied to the species in question. It sometimes happens that workers are misled about such aspects as habits, ecology, economic importance, or proper methods of control, because of a misidentification. Among the biting flies, for example, one species may be a proven vector of a disease and a closely allied one harmless in this respect; misidentifications in such instances could lead to loss of life or to an expenditure of time, energy, and money on unnecessary control programs.

Reports or publications based on misidentified species give rise to much confusion in the literature. In early reports on the investigation of bubonic plague in India, the species of flea claimed to be the vector of the disease among rats (the bubonic plague inf ection is transmitted from rats to man) was not a rat flea. Such reports serve to conceal the true vectors and thus retard remedial measures.

The investigator should always bear in mind that many species resemble each other closely, and are easily confused. If there is doubt about an identification and the matter is important, a series of specimens (up to 25 or 100) should be sent to a competent authority.

Where to Obtain Identification Service

The Entomology Division, Canada Department of Agriculture employs specialists to provide identification service.

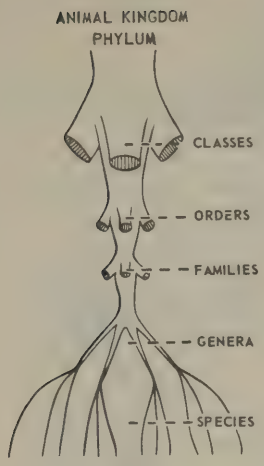
Address correspondence to:

Insect Systematics and Biological
Control Unit,
Entomology Division,
Science Service Building,
OTTAWA, Canada.

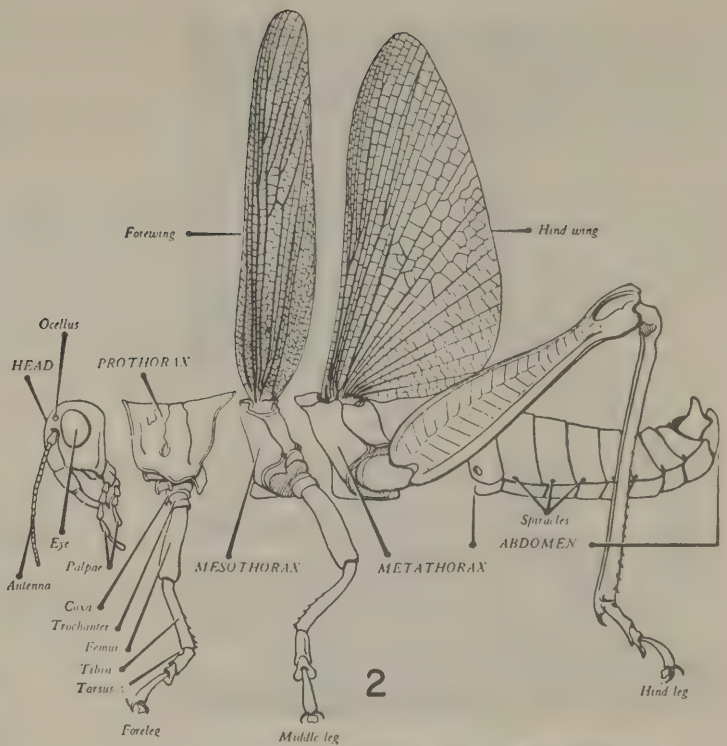
Also, advantage should be taken of facilities provided by the biological and entomological departments of various universities and federal entomological laboratories throughout Canada.

METHODS OF COLLECTING AND PREPARING INSECTS FOR STUDY

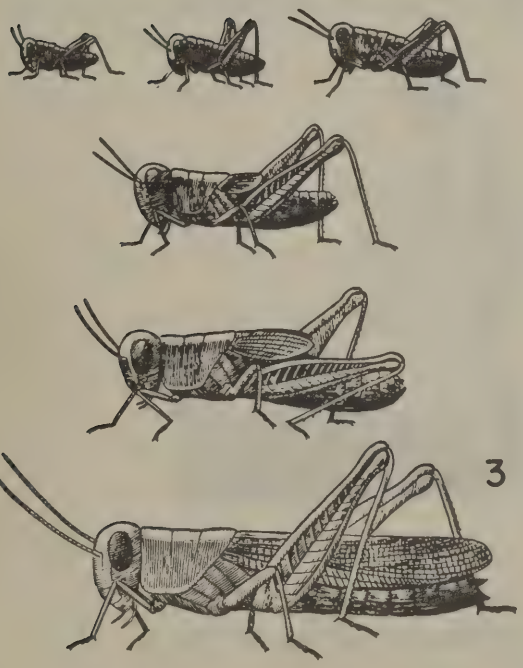
It is realized that the users of this manual will not be seeking insects as such; nor will they usually be interested in preparing them as permanent specimens. However, a few hints on collecting and preserving are offered since they are useful upon occasion. Proper preparatory methods always improve the possibility of obtaining a specific identification. For a more complete discussion of the methods of collecting and preparing insects consult: Beirne, Bryan P. 1955. Collecting, Preparing and Preserving Insects (compiled by


ANIMAL KINGDOM
PHYLUM
CLASSES
ORDERS
FAMILIES
GENERA
SPECIES

1


Forewing
Hind wing
Ocellus
HEAD
PROTHORAX
Eye
Palpus
Antenna
Coxa
Trochanter
Femur
Tibia
Tarsus
Foreleg
MESOTHORAX
METATHORAX
Middle leg
Spiracles
ABDOMEN
Hind leg

2



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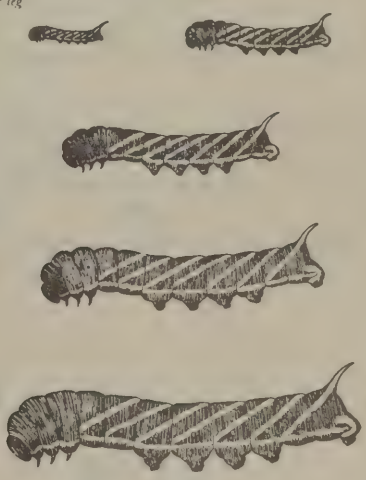
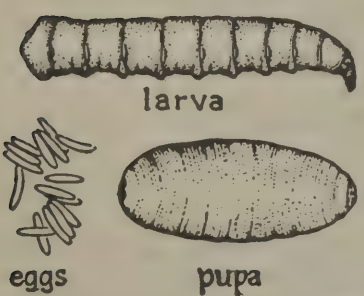
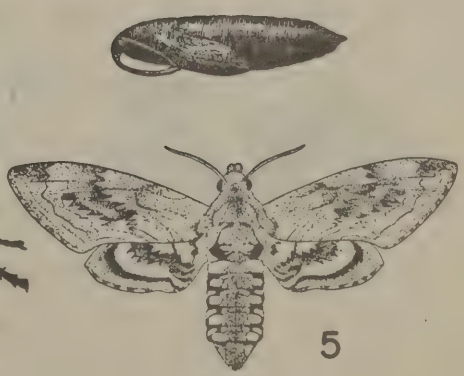



larva
eggs
pupa

4


adult



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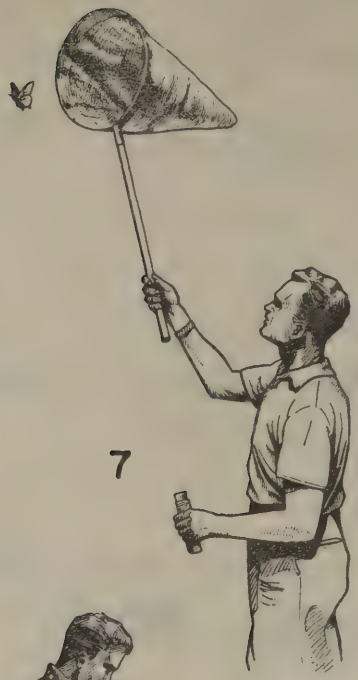
6



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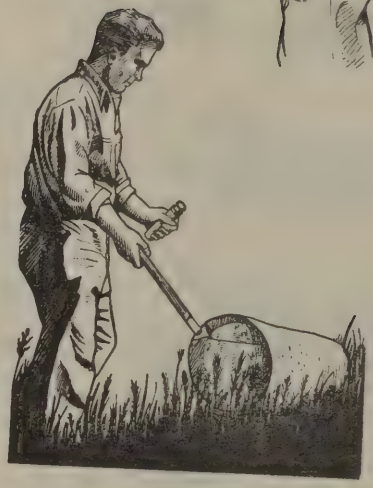

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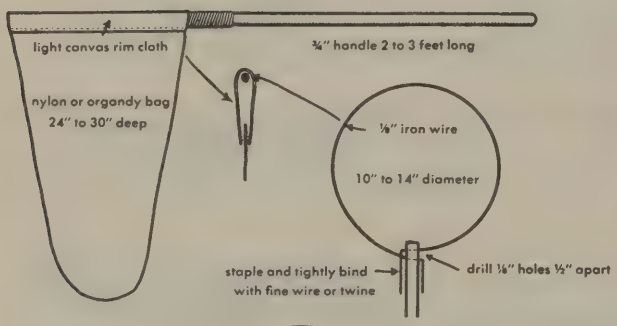
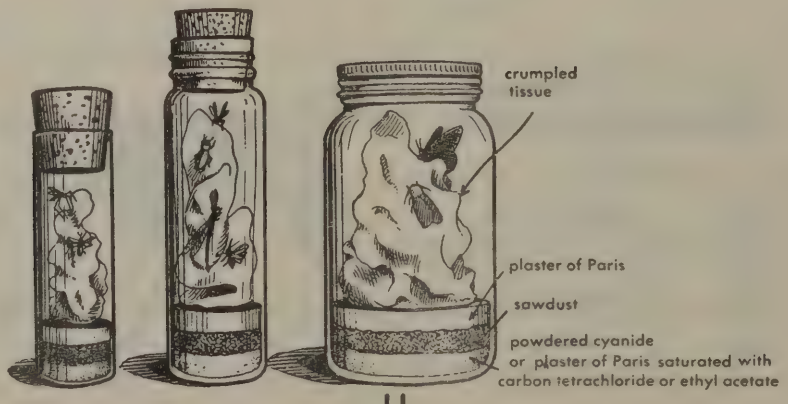

light canvas rim cloth
¾" handle 2 to 3 feet long
nylon or organdy bag
24" to 30" deep
⅛" iron wire
10" to 14" diameter
staple and tightly bind
with fine wire or twine
drill ⅛" holes ½" apart

9

10


crumpled
tissue
plaster of Paris
sawdust
powdered cyanide
or plaster of Paris saturated with
carbon tetrachloride or ethyl acetate

11

B.P. Beirne). 133 pp., Canada Dept. of Agr. Pub. 932.

Finding and Catching Insects

The traditional tool of the insect hunter is the aerial net. It is used for collecting insects that fly and/or rest on vegetation (Figs. 7,8). Such a net may be purchased at a supply house or made according to the diagram (Fig. 9).

One of the best methods of collecting insects is by searching (Fig. 10). All one needs besides collecting jars and vials are sharp eyes, foreceps, and an instrument such as a stout knife or screw driver for prying.

Care in Handling

Specimens collected for subsequent study should be handled with utmost care. Fragile legs, antennae, scales, hairs, and bristles, often indispensible for the identification of species, are easily lost or broken by rough, careless, handling. This is true of all kinds of insects but particularly so of moths, butterflies, and flies.

Killing

Most experienced collectors prefer the lethal fumes of cyanide for killing insects, but this chemical is extremely dangerous. Ethyl acetate (banana oil), carbon tetrachloride, ether, or chloroform are all good, relatively safe substitutes. Blotting paper, rubber bands, a tight wad of cotton, or a layer of plaster of Paris may be placed in the bottom of the container to carry such killing agents. These volatile liquids will dissipate and should be replenished from a stock bottle.

Preserving in Alcohol

Many insects, including all immature stages, most wingless forms, all aquatic forms, mayflies, caddisflies, and beetles as well as spiders, centipedes, ticks, and mites, may be killed and permanently stored in vials containing fluid preservative (70 to 80 per cent alcohol), (Fig 12). These vials must be tightly stoppered or sealed to prevent the alcohol from evaporating.

Mounting (Pinning) Large Hard-bodied Specimens

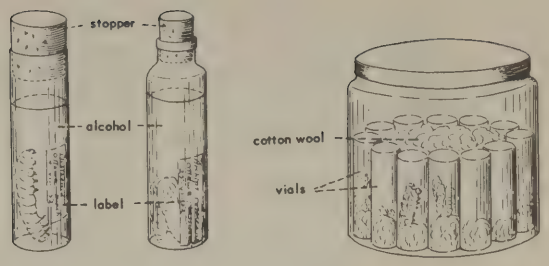
Large insects (over one-quarter inch in length) should be carefully "pinned" with special insect pins (a small needle is the best substitute) through particular parts of the body (Fig. 13). Pin the insect so that it doesn't tip sidewise, forward or backward. Push the specimen up the pin until its back is half an inch or slightly less from the top.

Mounting Small Hard-bodied Specimens

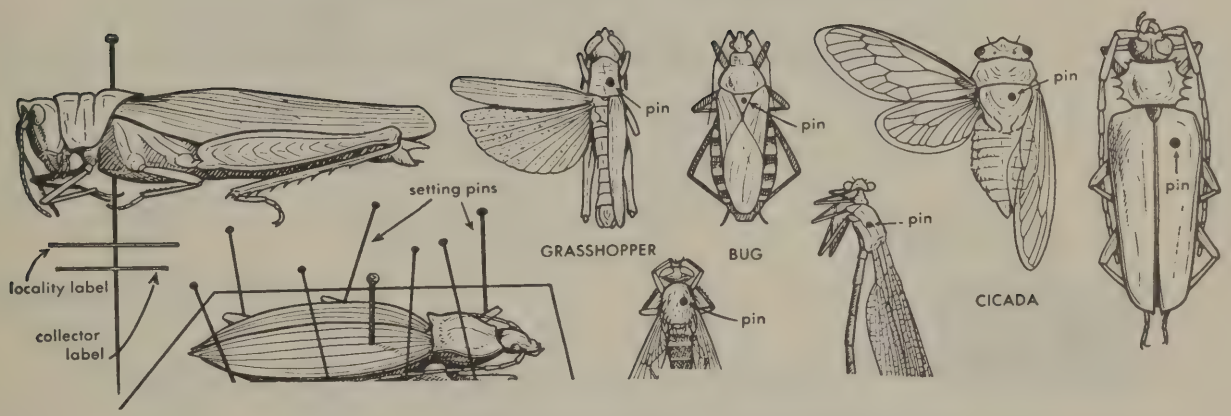
In general, never pass pins through insects that are less than one-quarter of an inch long. With the exception of small flies, "glue" each to the tip of a small triangle of stiff paper that has been transfixed by a pin (Fig. 14). Small flies should be glued directly to the side of the pin (Fig. 15). A very small amount of either colourless nail polish, ordinary glue, or thick, white shellac makes a satisfactory adhesive.

Papering and Layering

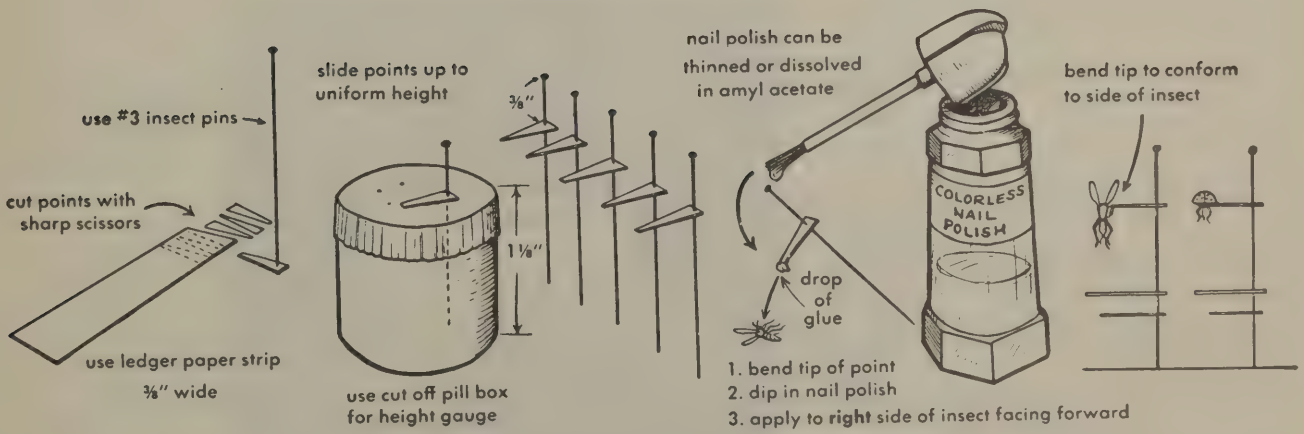
If they cannot be mounted properly, moths, butterflies, dragonflies, and other large-winged insects may be placed individually in envelopes or in triangular folds of paper (Fig. 16).


stopper
alcohol
label
cotton wool
vials

12

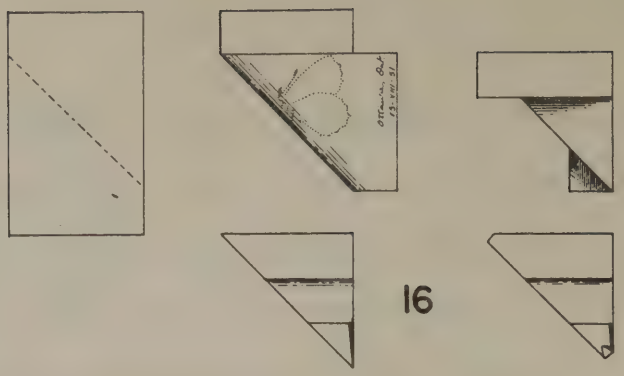

setting pins
locality label
collector label
pin
GRASSHOPPER
pin
BUG
pin
pin
CICADA
pin
pin

13


use #3 insect pins
cut points with sharp scissors
use ledger paper strip
⅜" wide
slide points up to uniform height
⅜"
1 ⅛"
use cut off pill box for height gauge
nail polish can be thinned or dissolved in amyl acetate
COLORLESS NAIL POLISH
drop of glue
1. bend tip of point
2. dip in nail polish
3. apply to **right** side of insect facing forward
bend tip to conform to side of insect

14

15



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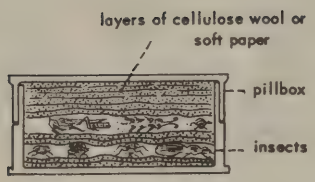
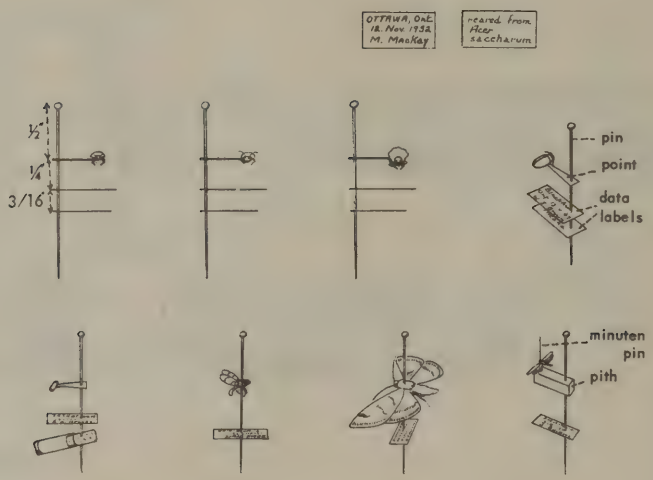
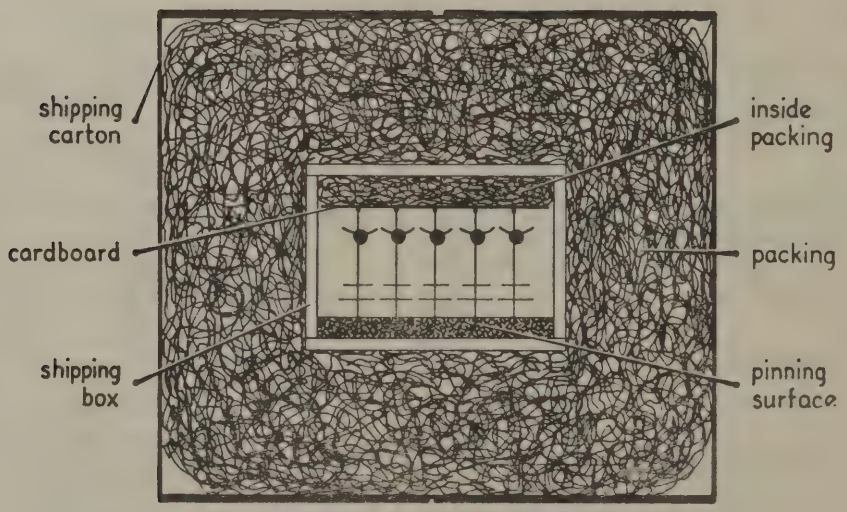

layers of cellulose wool or soft paper
pillbox
insects

17


½
¼
3/16
pin
point
data labels
minuten pin
pith

18


shipping carton
cardboard
shipping box
inside packing
packing
pinning surface

19

Grasshoppers, bugs, beetles, flies, and other stout-bodied insects may be placed between layers of glazed cotton wool or facial tissue, in small cardboard boxes such as pill boxes (Fig. 17). Carefully "layered" material is preferable to material that has been poorly mounted or that has been mutilated in the process of mounting it.

Labelling

Each collection, whether one insect on a pin, a series in a vial of alcohol, or a layer in a pill box, should be accompanied by a label indicating locality, date, and the collector's name (Fig. 18). Insects without data are useless.

Packing for Shipping

For shipping pinned material, use a wooden or heavy cardboard box deep enough to accommodate the pins. The bottom of the box should be lined with cork, balsa wood, or heavy corrugated cardboard so that the pins driven into it will hold firmly. Firmly glue the pinning surface to the bottom of the box. A piece of light cardboard, cut to the size of the shipping box, should be laid on the support formed by the pinheads and the space above filled with cotton wool or similar material to hold the paper in place.

It is best to wrap the shipping box in paper and then place it in a corrugated cardboard box or carton large enough to hold a protective layer of loose cotton, excelsior, or crumpled paper. Surround the usual small shipping boxes (cigar box size) with at least 2 1/2 inches of packing. Layered material should be equally carefully packed. Material in vials should be firmly stoppered and wrapped individually within the shipping box to prevent breakage.

How to Begin to Identify a Specimen

An individual faced with the task of identifying an insect should first kill it by one of the methods already outlined. Next, it may be necessary to mount the specimen or otherwise prepare it for study. Then, with the aid of proper optical equipment described below, proceed to "key it out" to its proper class or order in the "Key to Some Common Classes and Orders of Arthropods" page (Directions on the methods of using a key are given below). Having traced the specimen to its proper category in this key, the identifier, in many instances, will be directed elsewhere in the Manual for additional information.

Equipment Necessary

A common stereoscopic microscope is essential to observe many of the minute characters of insects. A good hand lens is often very useful for field examination of specimens and can sometimes substitute for a binocular microscope for quick checking of characters. With practice most of the insects dealt with below can be recognized "at sight" with the naked eye.

Properly mounted specimens are to be desired for microscopic study, but often it is not necessary nor feasible to make permanent mounts of specimens to identify them. Forms which have been killed and stored in alcohol (see above) usually can be observed satisfactorily if immersed in a small amount of alcohol in a shallow watch glass or petri dish; fine dissecting needles are used to manipulate the specimens. Freshly killed specimens, if placed on white paper or cardboard, can be studied in the same manner.

How to Use Taxonomic Keys

Almost all of the keys provided here are of the opposing couplet type. They are used as follows: if the specimen to be identified agrees with what is stated in the first half of the couplet, the identifier proceeds to the couplet designated by the number at the end of the dotted line; if it does not, the specimen must then fall in the second half of the couplet and the identifier is led to a different couplet. In either case, the process is then repeated using other characters until the name of the taxonomic category to which the specimen belongs is reached.

SOME COMMON CLASSES AND ORDERS

OF ARTHROPODS[1]

Key to Adults

1. With at least four pairs of legs, sometimes many more.....2

   With three pairs of legs.....(Class INSECTA).....7

2. With four pairs of legs.....(Class ARACHNIDA).....3

   With more than four pairs of legs.....5

3. Body round or oval, unsegmented (Figs. 1,2)*, usually consisting of a single sac-like region.....ticks and mites, Order ACARINA, p.

   Body divided into two regions, a combined head-thorax, i.e., cephalothorax (Fig. 3,a) and an abdomen (Fig. 3,b).....4

4. Abdomen joined to cephalothorax by a slender waist (Fig. 3,c); segmentation of abdomen indistinct or absent (Fig. 3,b)..... .....spiders, Order ARANEIDA

   Abdomen broadly joined to cephalothorax (Fig. 4,a); segmentation of abdomen distinct (Fig. 4,b); apex of abdomen lengthened posteriorly to form a long tail with a sting at its tip (Fig. 4,c).....scorpions, Order SCORPIONIDA

5. Flattened, oval-shaped arthropods with seven pairs of legs (Fig. 5); found in damp places such as root houses, greenhouses, leaf mould, etc.....sowbugs, Order ISOPODA

   Elongate "worms" with more than ten pairs of legs (Figs. 6,7).....6

6. Body segments each with one pair of legs (Fig. 6)..... .....centipedes, Class DIPLOPODA, p.

   Body segments each with two pairs of legs (Fig. 7)..... .....millipedes, Class DIPLOPODA, p.

7. Wings present, well developed (Figs. 8-12). Hard shell-like wing covers of beetles (Fig. 10), earwigs (Fig. 11), and cockroaches (Fig. 12) represent a pair of wings; these may be short as in earwigs.....8

   Wings absent or reduced to minute pads (Figs. 13-16).....31

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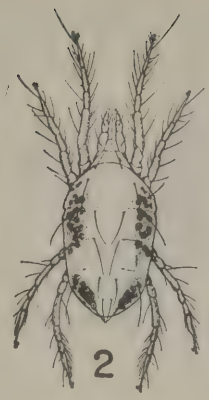
[1]For more complete keys, see texts listed in the Introduction.

*The figures throughout this section are not drawn to the same scale.

1



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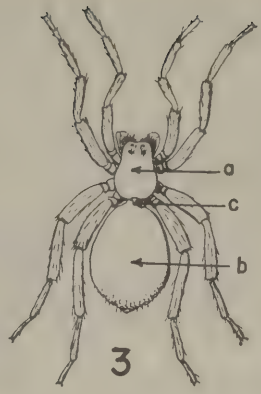

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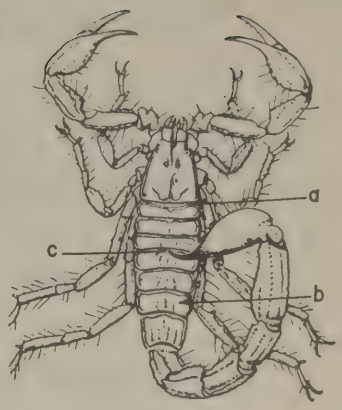

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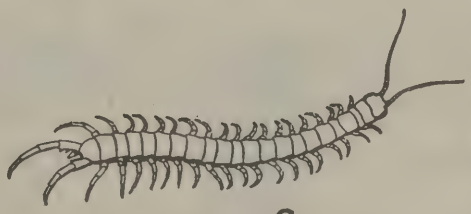

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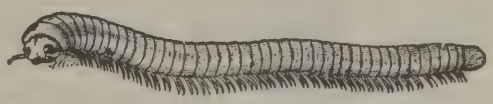

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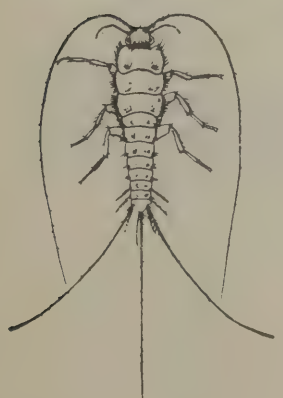

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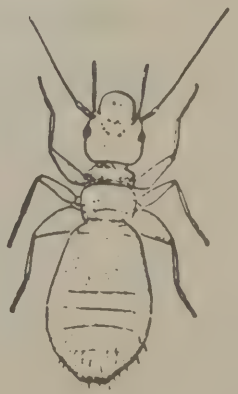

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8. With one pair of wings (Fig. 17) and a pair of small club-like balancing organs, i.e. halteres (Fig. 18,a).....
.....true flies, Order DIPTERA, p.

With two pairs of wings (when the front pair are shell-like or leathery, a second pair may be assumed to be present beneath them) (Figs. 19-21, 26).....9

9. Front wings opaque, hard and shell-like (Fig. 21,a) covering a pair of membranous hind ones folded beneath them (Fig. 21,b).....
.....beetles, Order COLEOPTERA, p.

Wings otherwise.....10

10. Wings clothed with overlapping scales (Figs. 22a, 23); proboscis, when at rest, coiled under the head (Fig. 22,b).....
.....moths and butterflies, Order LEPIDOPTERA, p.

Wings otherwise; proboscis, if present, not coiled.....11

11. Membranous area of wings with short hairs and scales (Figs. 24, 25); mouth-parts poorly developed (Fig. 25,a).....
.....caddis flies, Order TRICHOPTERA

Not agreeing with above characters.....12

12. Front (Fig. 27,a) and hind wings (Fig. 27,b) of the same membranous texture, usually transparent but sometimes smoky-coloured or with darker spots.....13

Front wings opaque and leathery (Fig. 19,a, 20,a, 26), usually forming a protective cover over the thinner more transparent hind wings (Figs. 19,b, 20,b).....26

13. Hind wings connected to the front wings by a series of minute hooks (Fig. 29) so that in flight both wings move as one (Fig. 28).....
.....bees and wasps, Order HYMENOPTERA, p.

Hind wings free from the front ones.....14

14. Antennae very short, inconspicuous (Fig. 27).....15

Antennae long and thread-like (Fig. 20).....17

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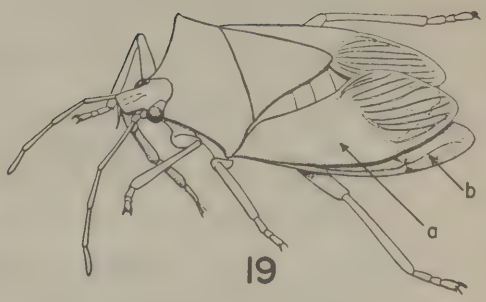

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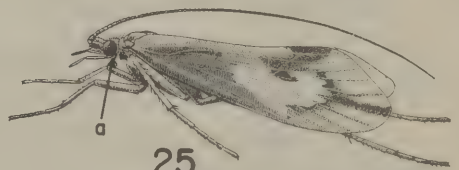

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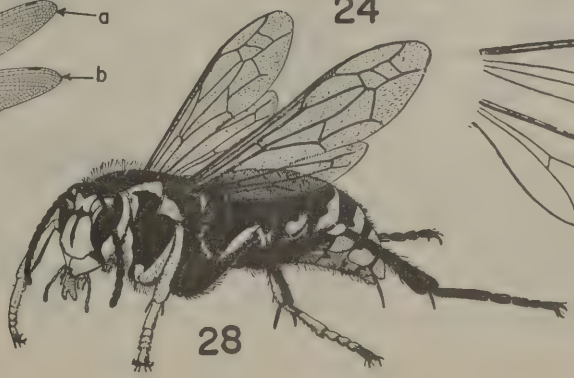

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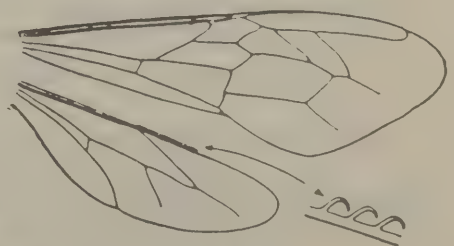

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15. Front and hind wings elongate, almost equal in size, and often extended aeroplane-like when at rest (Fig. 30); eyes very large (Figs. 30, 31).....dragonflies and damselflies, Order ODONATA

Not as above.....16

16. Wings, when at rest, held together above the thorax, perpendicular to the main axis of the body; apex of body with two or three filaments which are at least as long as the body (Fig. 32).....
.....mayflies, Order EPHEMERIDA

Wings, when at rest, held roof-like over the body; abdomen without long terminal filaments (Figs. 33-35).....
.....cicadas, some leafhoppers and treehoppers, Order HOMOPTERA

17. Hind legs fitted for leaping, i.e., femora (thighs) strongly developed; front wings milky or greenish in colour, rather leathery in texture (Figs. 36-38).....
..tree crickets, some grasshoppers, katydids, Suborder SALTATORIA

Hind legs not adapted for jumping.....18

18. Large insects, i.e., several inches long, with greenish or brownish wings; front legs adapted for grasping, held in front of the body in a "praying" attitude when at rest (Fig. 39).....
.....praying mantids, Suborder MANTODEA

Not as above.....19

19. Very small "louse-like" insects; wings narrow, margined with long hairs (Fig. 40); often found in flower-heads.....
.....thrips, Order THYSANOPTERA

Much larger insects, usually not attracted to flowers.....20

20. Head elongate, snout-like in side view; wings spotted or speckled (Fig. 41).....scorpionflies, Order MECOPTERA

Not as above.....21

21. One-half inch or more in length; wings overlapping and lying flat on the back, usually dusky-brown or pale-green in colour; end of abdomen with a pair of stout handle-like appendages; mouth parts adapted for biting and chewing (Fig. 42).....
.....stoneflies, Order PLECOPTERA

Not as above.....22

22. One-fourth inch or less in length (Figs. 43,44); wings, when at rest, held roof-like over the body; abdomen usually with a pair of cornicles near the apex (Fig. 43,a); mouthparts beak-like adapted for sucking (Fig. 43,b).....aphids or plant lice, Order HOMOPTERA

Not as above.....23

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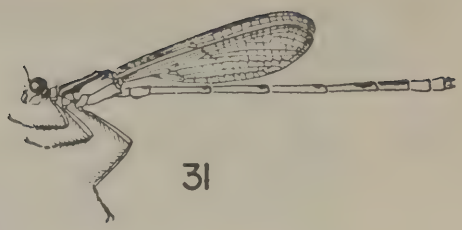

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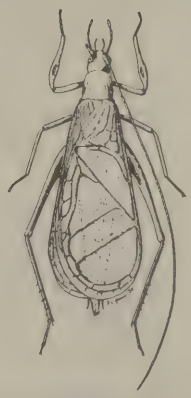

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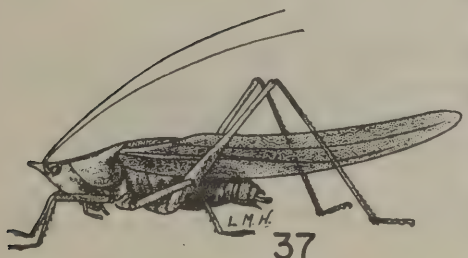

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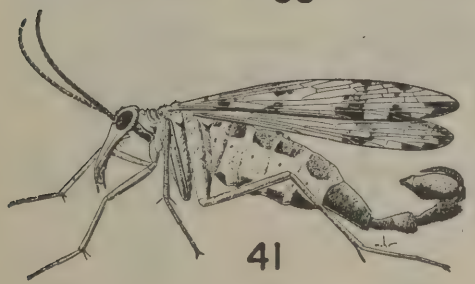

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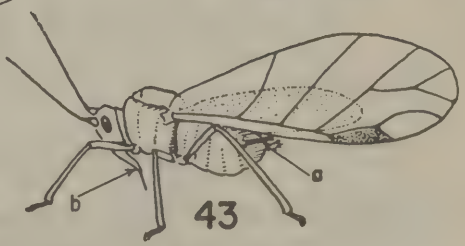

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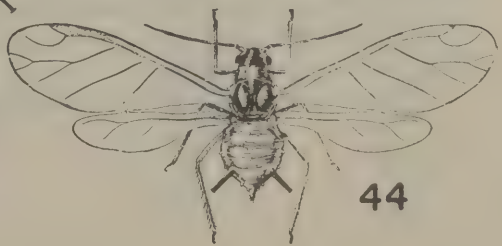

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23. Tarsi with five segments (Fig. 45,a).....24

Tarsi with two or three segments (Fig. 46,a).....25

24. Wings delicately net-veined, held roof-like over the body when at rest; pale-green or light-brownish insects (Figs. 47, 48); pronotum usually less than half as long as wide (Fig. 48,a)..... .....lacewings, Order NEUROPTERA

Wings overlapping, at least along the mid-line; not so distinctly roof-like nor so delicately net-veined; brownish or smoky-black insects; sometimes several inches in length (Figs. 49, 50); pronotum always more than half as long as wide (Fig. 49,a)..... .....dobsonflies and alderflies, Order MEGALOPTERA

25. Wings with anterior veins, only, strongly developed (Fig. 51,a), the remaining veins weak and indistinct (Fig. 51,b); living in ant-like colonies.....winged termites, Order ISOPTERA, p.

All wing veins equally strong; not living in ant-like colonies (Fig. 52).....winged psocids, Order CORRODENTIA

26. Robust insects, an inch or more in length, with hind femora enlarged for leaping (Fig. 53,a); front wings narrow and opaque; hind wings membranous, folded fan-like beneath the front ones; antennae long, conspicuous (Figs. 53,54,56)..... .....grasshoppers, crickets, Suborder SALTATORIA

Not as above.....27

27. Small elongate, or triangular insects, less than half an inch long, that "jump" when disturbed; femora are not so swollen; antennae bristle-like and inconspicuous (Figs. 57,58)..... .....leafhoppers, treehoppers and spittle bugs, Order HOMOPTERA

Not as above; antennae usually long; non-jumping insects.....28

28. Front legs adapted for grasping and held in front of the body in a praying attitude when at rest; large insects up to two or three inches long, with stout bodies (Figs. 55,59)..... .....praying mantids, Suborder MANTODEA

Not as above, usually an inch or less in length.....29

29. Front wings small and scale-like, hind wings hidden beneath front ones; apex of abdomen with a pair of forceps-like appendages (Figs. 60,61).....earwigs, Order DERMAPTERA

Not as above, wings usually concealing the abdomen.....30

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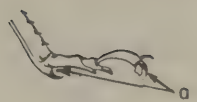

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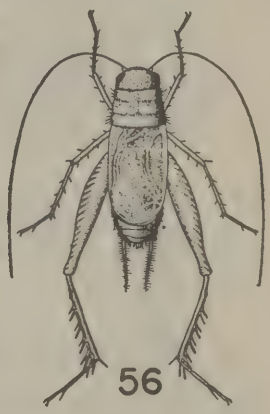

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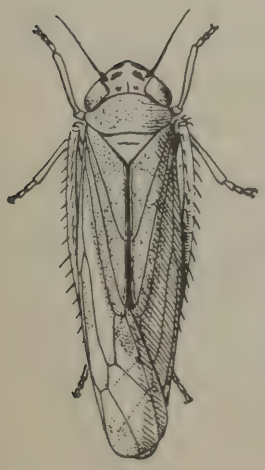

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30. Head mostly concealed by thorax when viewed from above; front wings uniformly leathery; brownish to black, rapidly running insects with long, thread-like, many-segmented antennae (Fig. 62).....
.....cockroaches, Suborder BLATTARIA, p.

Head not at all concealed; front wings opaque at base and membranous at the apices; antennae with fewer than ten segments (Figs. 63,64)
.....true bugs, Order HEMIPTERA

31. Abdomen ending in three long "tails"; small insects, half an inch or less in length, with soft bodies (Fig. 65).....
.....silverfish, fire brats, Order THYSANURA

Not as above, abdomen without three long tails.....32

32. Body long and slender, up to four inches long, twig-like; legs long and slender; head small; antennae long and threadlike (Fig. 66)...
.....walking sticks, Suborder PHASMIDA

Not twig-like in appearance.....33

33. Hind femora enlarged for leaping; large free-lining insects, up to one or two inches long (Figs. 67-69).....
.....nymphs of crickets, grasshoppers, Suborder SALTATORIA

Not as above, non-jumping insects.....34

34. Head largely concealed by thorax; antennae long, thread-like, and many-segmented; swift-running brown or blackish insects; up to an inch or more in length; often found in dwellings (Fig. 70).....
.....cockroach nymphs, Suborder BLATTARIA

Not as above.....35

35. Antennae elbowed; abdomen connected to thorax by a slender waist; small insects, usually less than one-half inch long; dark-brown or black in colour (Fig. 71-73).....ants, Order HYMENOPTERA, p.

Not as above.....36

36. Stout-bodied, whitish, ant-like insects; thorax constricted and markedly narrower than either the head or abdomen; living in ant-like colonies in wood or wood products (Figs. 74-77).....
.....termites, Order ISOPTERA, p.

Not as above, never living in colonies in wood.....37

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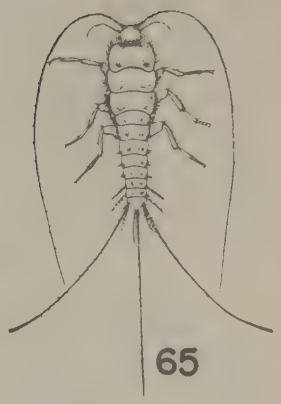

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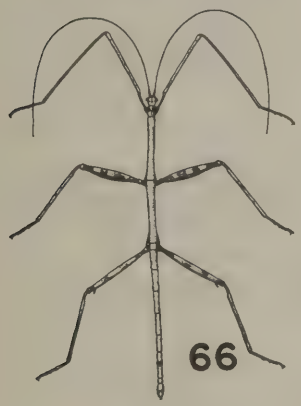

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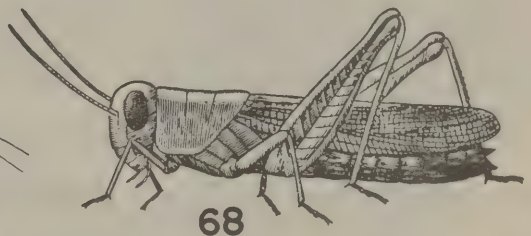

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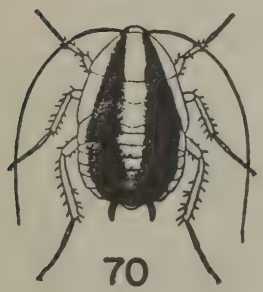

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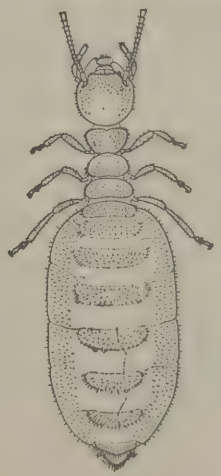

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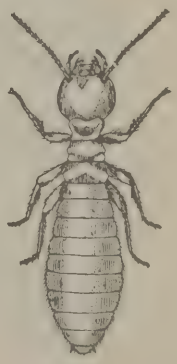

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37. Minute insects (Figs. 78-80), an eighth of an inch or less in length, living beneath a waxy exudate or powdery scales (Fig. 79) on plants.....scales and some aphids, Order HOMOPTERA

Not living under wax or scales.....38

38. Abdomen usually with a pair of cornicles (Fig. 82,a); small, one-fourth inch or less in length, soft bodied "lice" living on plants (Figs. 81-83).....aphids or plant lice, Order HOMOPTERA

Not as above; cornicles absent.....39

39. Body laterally compressed (Fig. 85); head and thorax often with rows of stout spines; legs fitted for jumping; small, less than one-fourth inch; external parasites of birds and mammals (Figs. 84, 85).....fleas, Order SIPHONAPTERA,p.

Not as above, body never laterally compressed.....40

40. Mouthparts forming a distinct external beak beneath the head (Fig. 86); abdomen strawberry-shaped from above, small, one-fourth inch or less in length; brownish ectoparasites of man, birds, and bats (Fig. 87).....bedbugs, Order HEMIPTERA,p.

Not as above, always smaller.....41

41. Each tarsus ending in bladder-like pad; minute, elongate insects frequently found in flowers, in leaf mould, or under bark (Figs. 88-90).....thrips, Order THYSANOPTERA

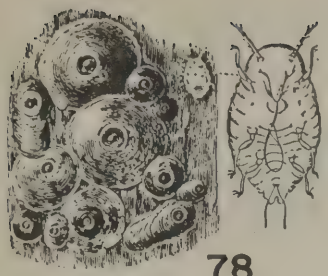
Not as above.....42

42. Antennae with 13-50 segments; minute insects sometimes found about libraries and in books (Fig. 91)....book lice, Order CORRODENTIA

Not as above; parasites of warm-blooded animals.....43

43. External parasites of mammals, tarsi fitted with one movable claw adapted for clasping hairs (Fig. 92,a); head narrow (Figs. 92, 93).....sucking lice, Order ANOPLURA

External parasites mainly of birds, sometimes of mammals; tarsi usually with two claws (Fig. 95,a); head broad (Figs. 94,95).....
.....bird lice, Order MALLOPHAGA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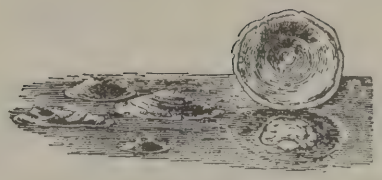
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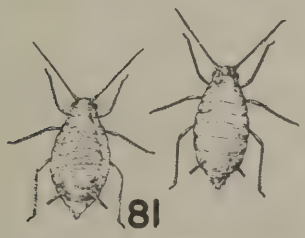
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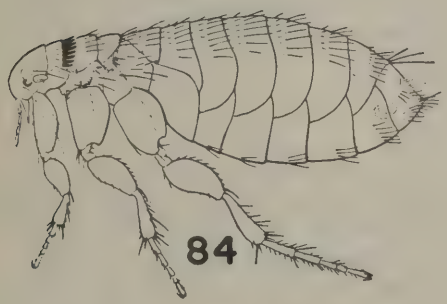
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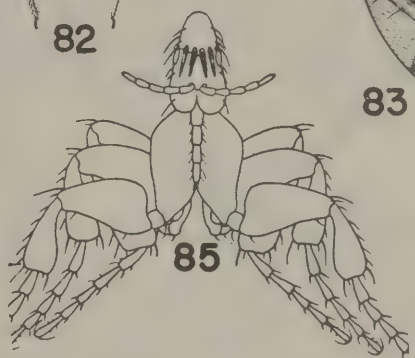
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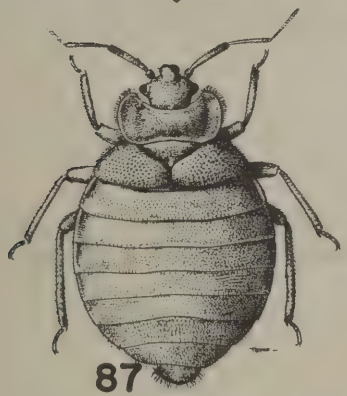
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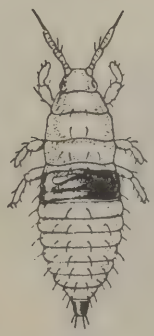
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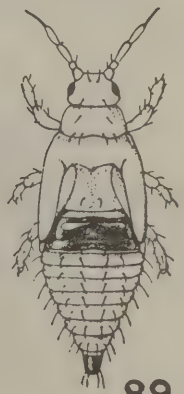
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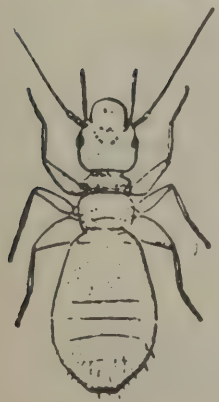
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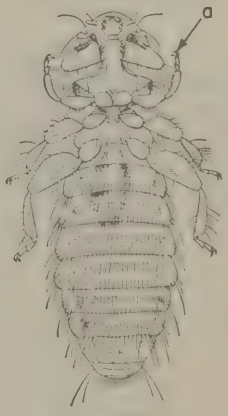
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A few of the arthropod groups closely related to the Class Insecta are reviewed here. Some of their members are encountered frequently, and occasionally they are confused with true insects. This is especially true of such forms as sow bugs, spiders, ticks, and mites.

Class Crustacea

Class Crustacea includes a great variety of forms (Fig. 1), including lobsters, fairy shrimps, ostracods, copepods, crabs, shrimps and isopods. It is difficult to give a brief diagnosis that would apply to all, but most of them are aquatic and breathe by means of gills. All have the following characteristics; body composed of head, thorax and abdomen; head and thorax often closely joined to form a cephalothorax; thorax usually with 4 to 20 segments, each with a pair of legs; abdomen with one to many segments.

Class Arachnida

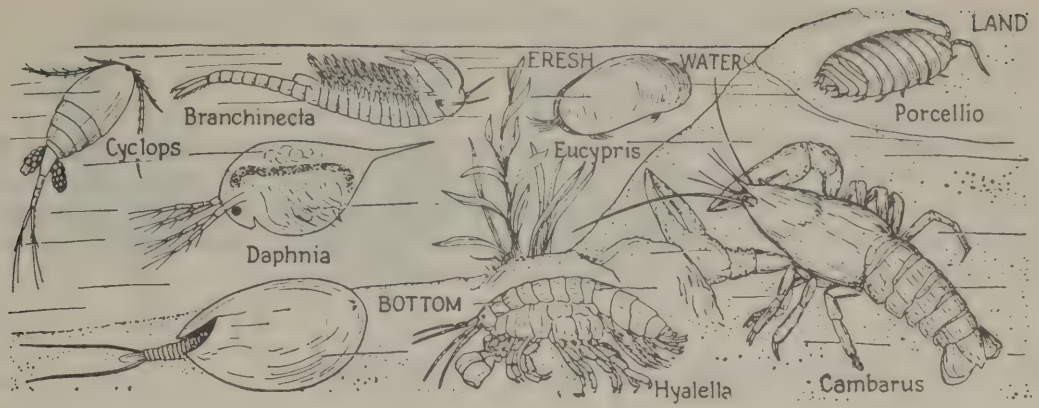
Class Arachnida contains scorpions (Fig. 2), spiders, (Figs. 3,4), mites (Figs. 5,6), and ticks (Figs. 7,8). All posses four pairs of legs in their adult stages; the head and thorax are fused to form a cephalothorax; the abdomen bears only traces of segmentation in the spiders; in the scorpions, however, it is clearly segmented and is lengthened posteriorly to form a long tail with a sting at the tip.

Class Diplopoda

Class Diplopoda includes the thousand-legged worms or millipedes (Figs. 9, 10). The body segments have fused in pairs so that each apparent segment bears two pairs of legs.

Class Chilopoda

In class Chilopoda belong the centipedes (Figs. 11, 12), which, like the millipedes, are many segmented, many-legged animals. The centipedes, or hundred-legged worms, have only one pair of legs on each segment. One species, the house centipede (Fig. 12), has excessively long legs; it is commonly found in houses. It is predaceous on other small forms of life but harmless to man.



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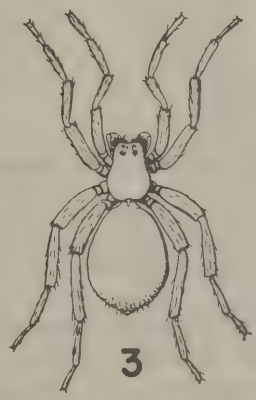

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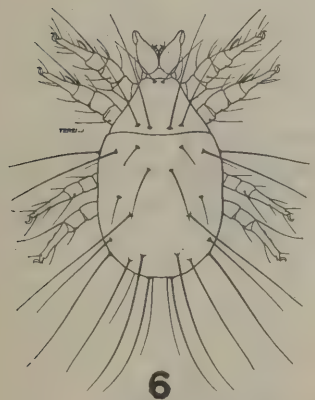

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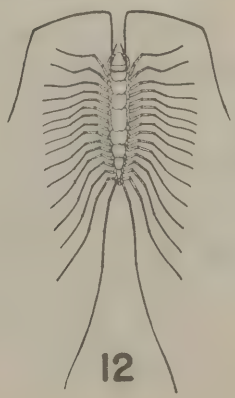

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Mites (see Section VIII) are usually very small, ranging in size from about 0.3 to several millimeters in length. The group is large, the classification complex and difficult, and keys for determination of the species cannot be given here. The illustrations that accompany the following notes will aid in identification of the species discussed.

The itch mite, Sarcoptes scabiei (DeG.), (Figs. 1-3).

The adult female burrows in the outer layers of the skin, laying her eggs and depositing faeces in the burrows. It is the cause of scabies or itch in man.

Grain mites, Tyroglyphus spp., (Figs. 4,5).

These mites sometimes cause skin irritation in persons.

Taronemid mites, Pyemotes ventricosus (Newp.), (Figs. 6-8).

Adults of this group are parasites of insect larvae and are often found in great numbers in insect-infested straw, cotton, grain, etc. People who come in contact with such material are attacked and consequently may suffer from dermatitis.

Clover mite, Bryobia praetiosa Koch., (Figs. 9,10).

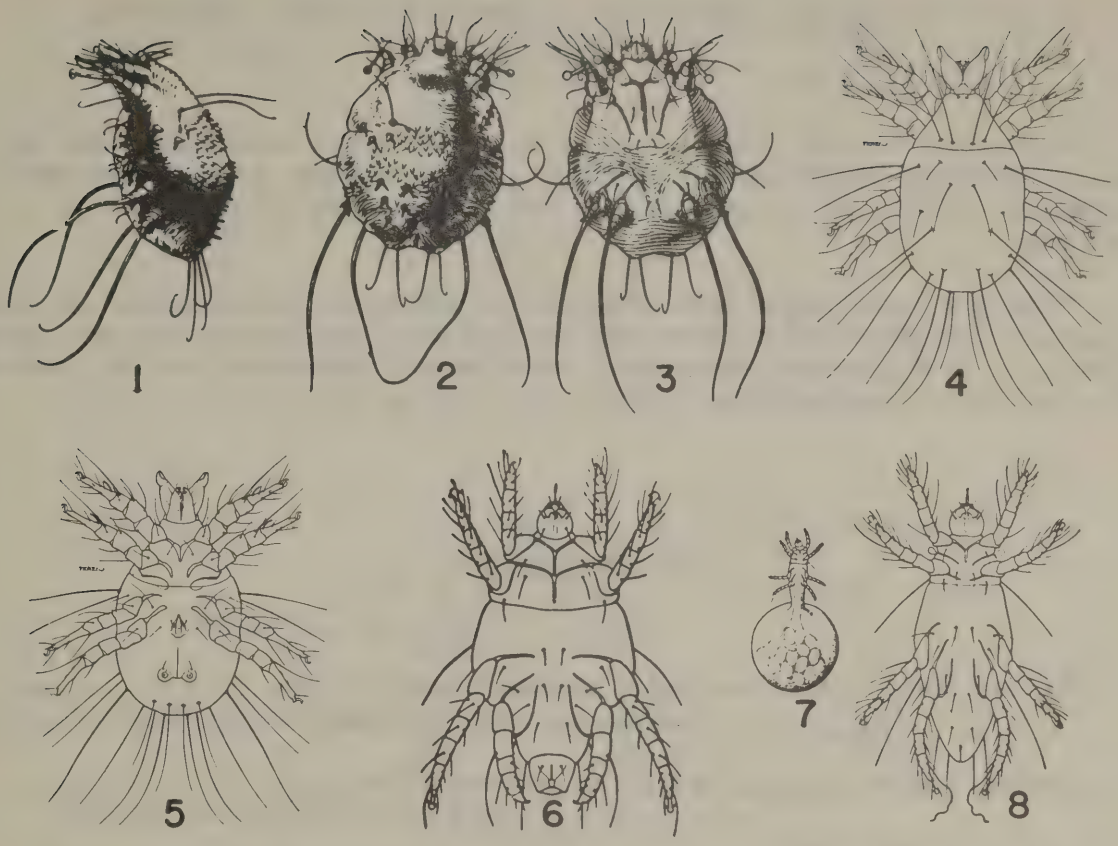
This is a small reddish "spider" mite that is sometimes found in great numbers on various plants, particularly red clover and alfalfa. Sometimes they invade houses and annoy the occupants by crawling about. So far as is known, they do no injury in the home.

Chicken mite, Dermanyssus gallinae (DeG.), (Figs. 11, 12).

This species is a common parasite of domestic birds. It has been frequently reported as attacking man.

Northern fowl-mite, Bdellpnyssus sylviarum (C. & F.), (Figs. 13, 14).

This is another species that ordinarily lives on birds, but may also attack and annoy man.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TICKS OF ECONOMIC IMPORTANCE IN CANADA (ACARINA : IXODOIDEA)

Ticks (see Section VIII) are more closely related to spiders than to insects. They are blood-sucking in habit. Twenty-seven species have been recorded in Canada. Of these, six are considered to be of economic importance.

Ticks are much larger than most mites, sometimes reaching half an inch in length. The males, as a rule, are smaller than the females and are often difficult to find; in many cases they never attach themselves to the host on which the female is parasitic.

Key to Adults[2]

1. Capitulum projecting anteriorly; scutum present (Figs. 3,4).....
.....hard ticks, Family IXODIDAE....2

   Capitulum hidden beneath body; scutum absent (Figs. 5, 6).....
.....soft ticks, Family ARGASIDAE

2. Anal groove anterior to anus, festoons absent (Figs. 7,8).....
.....Ixodes spp.....3

   Anal groove posterior to anus, festoons present, (Figs. 1,2,9,10).....4

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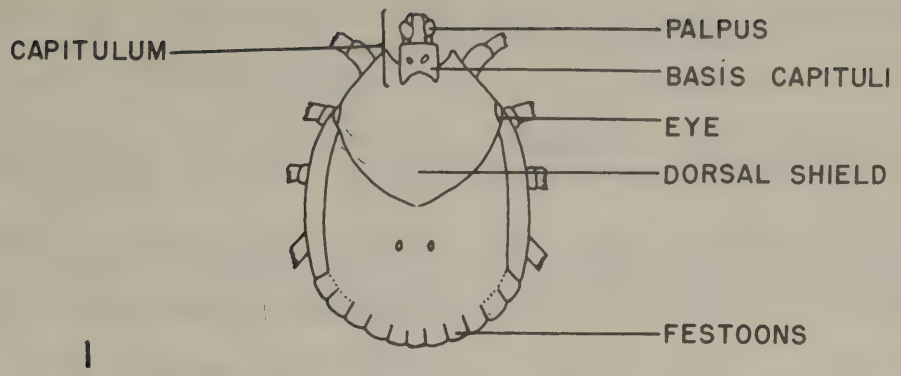
[2]For a full account of all Canadian species, consult: Gregson, J.D., 1956, "The Ixodoidea of Canada". Canada Dept. of Agr., Publication 930.



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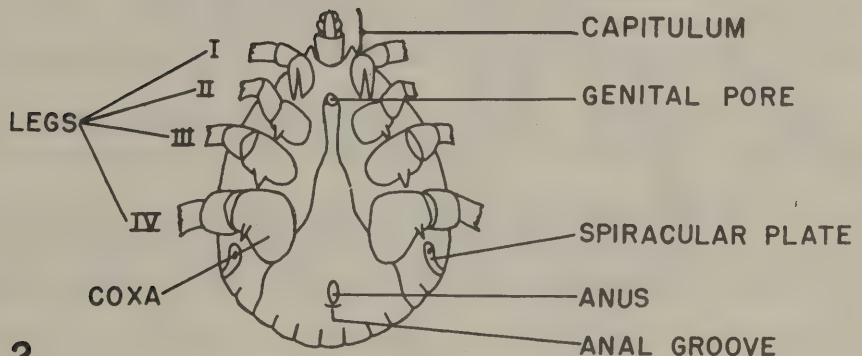
DORSAL ASPECT OF FEMALE HARD TICK



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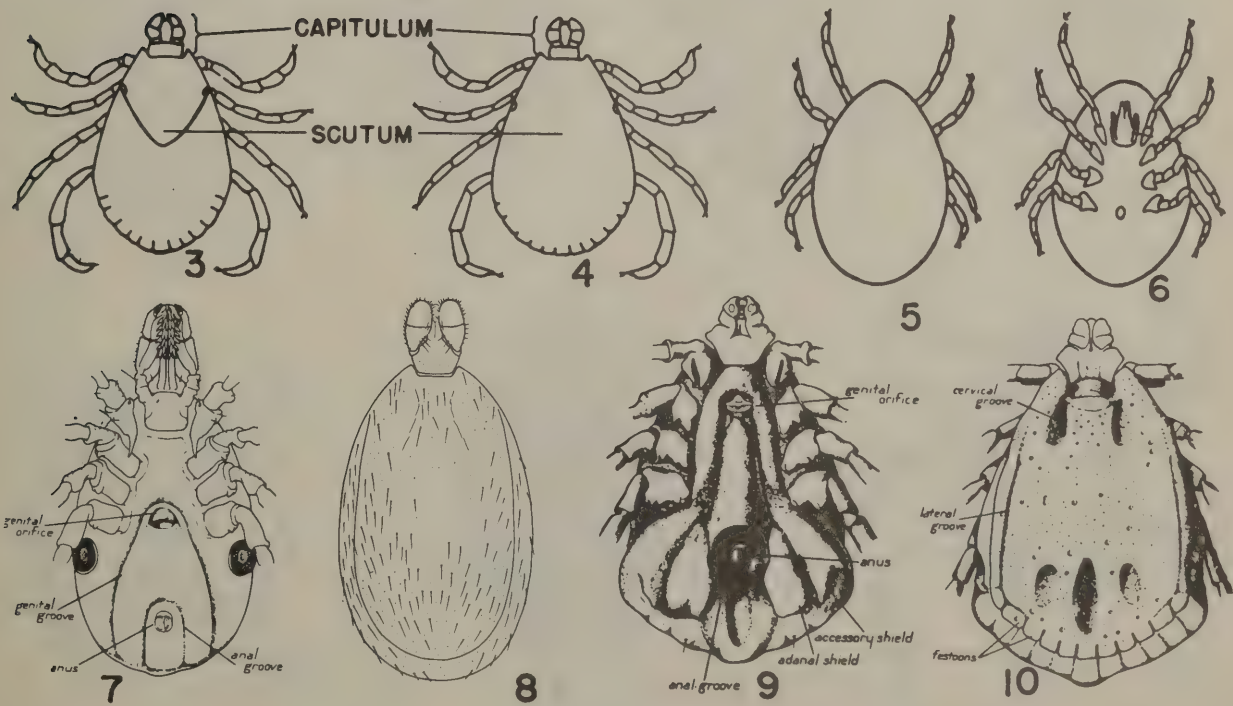
VENTRAL ASPECT OF MALE HARD TICK



3. Scutum circular (Fig. 11); legs, scutum and capitulum black (Figs. 11, 12); found in British Columbia west of the Coast Mountains..... .....I. pacificus Cooley and Kohls

Scutum angular (Fig. 13); legs, scutum and capitulum not dark (Figs. 13, 14); found in eastern Canada.....I. cookei Packard

4. Inornate (unspotted) ticks (Figs. 16, 17); basis capituli laterally produced (dorsally hexagonal) (Fig. 15); found in eastern Canada.....brown dog tick, Rhipicephalus sanguineus (Latr.)

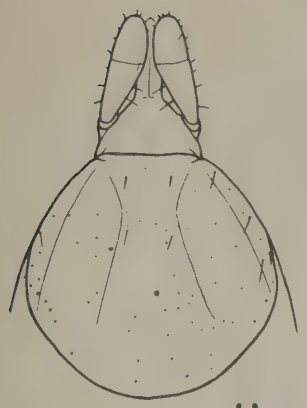
Ornate (spotted) ticks (Figs. 21, 23-25); basis capituli not laterally produced (dorsally rectangular) (Fig. 18)..... .....Dermacentor spp....5

5. Spiracular plate without dorsal prolongations (Fig. 19); goblets few and large (Fig. 19,a); species (Fig. 23) widespread in Canada.....winter tick, D. albipictus (Packard)

Spiracular plate with dorsal prolongations; goblets numerous and moderate to small in size (Figs. 20, 22).....6

6. Spiracular plate with goblets small in size and very numerous (Fig. 20); species (Figs. 21, 24) found from southeastern Saskatchewan east.....American dog tick, D. variabilis (Say)

Spiracular plate with goblets moderate in size and in number (Fig. 22); species (Fig. 25) found from south-central Saskatchewan west..... .....Rocky Mountain wood tick, D. andersoni Stiles



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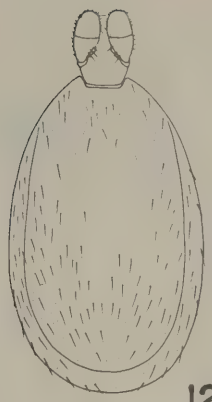

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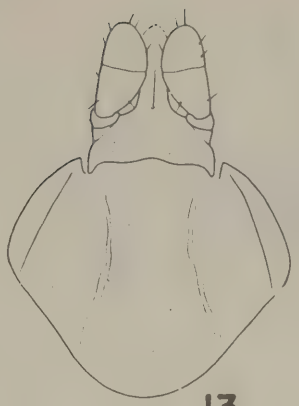

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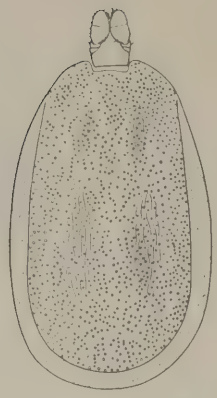

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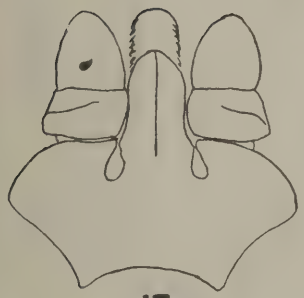

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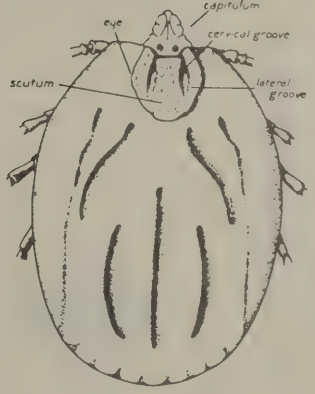

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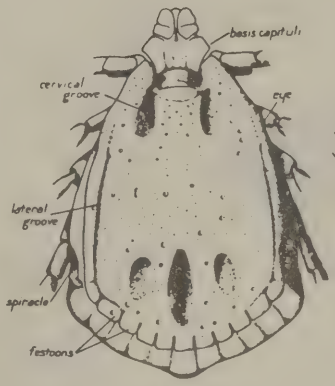

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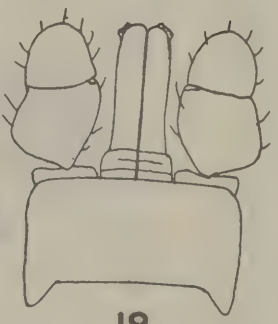

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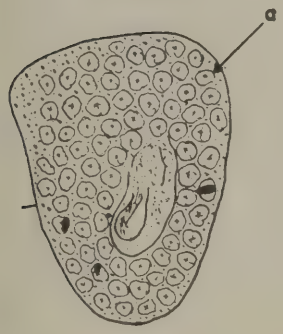

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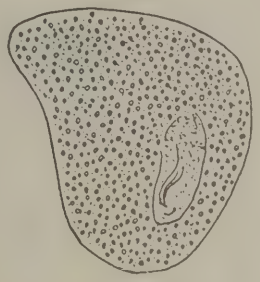

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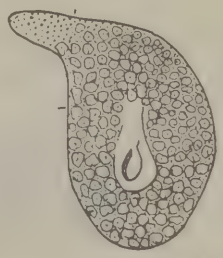

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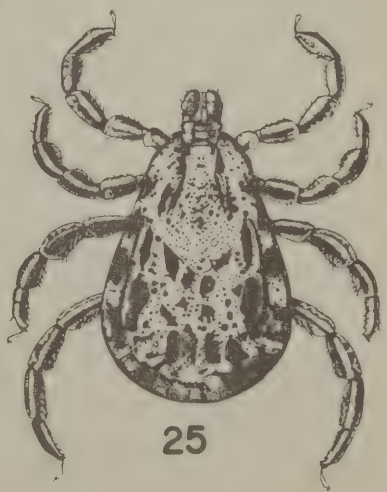

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PICTORIAL KEY TO SOME COMMON ADULT COCKROACHES

SMALL, ABOUT 5/8" OR SHORTER

PRONOTUM WITH 2 LONGITUDINAL BLACK BARS

GERMAN COCKROACH
(Blattella germanica)

PRONOTUM WITHOUT LONGITUDINAL BLACK BARS

WINGS COVERING ABOUT HALF OF ABDOMEN PRONOTUM ABOUT 1/4 INCH WIDE

WOOD ROACH
(Parcoblatta spp.)

WINGS COVERING NEARLY ALL OF ABDOMEN OR EXTENDING BEYOND. PRONOTUM NARROWER

BROWN-BANDED COCKROACH
(Supella supellectilium)

MEDIUM TO LARGE, LONGER THAN 5/8 INCH

WINGS ABSENT, OR SHORTER THAN ABDOMEN

WINGS ABSENT

WINGS SHORTER THAN ABDOMEN

ORIENTAL COCKROACH
(Blatta orientalis)

WINGS COVERING ABDOMEN, OFTEN EXTENDING BEYOND

PRONOTUM MORE THAN 1/4 INCH WIDE

PRONOTUM ABOUT 1/4 INCH WIDE WITH PALE BORDER

WOOD ROACH
(Parcoblatta spp.)

FRONT WING WITHOUT PALE STREAK. PRONOTUM SOLID COLOR, OR WITH PALE DESIGN ONLY MODERATELY CONSPICUOUS

PRONOTUM SOLID DARK COLOR. GENERAL COLOR VERY DARK BROWN TO BLACK.

SMOKY BROWN COCKROACH
(Periplaneta fuliginosa)

PRONOTUM USUALLY WITH SOME PALE AREA. GENERAL COLOR SELDOM DARKER THAN REDDISH CHESTNUT

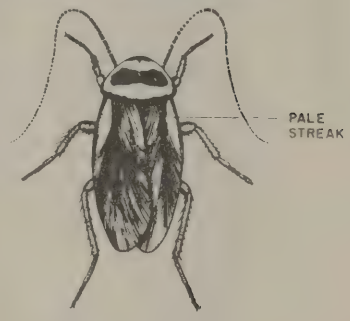
LAST SEGMENT OF CERCUS NOT TWICE AS LONG AS WIDE

BROWN COCKROACH
(Periplaneta brunnea)

LAST SEGMENT OF CERCUS TWICE AS LONG AS WIDE

AMERICAN COCKROACH
(Periplaneta americana)

FRONT WING WITH OUTER PALE STREAK AT BASE. PRONOTUM STRIKINGLY MARKED



AUSTRALIAN COCKROACH
(Periplaneta australasiae)

*See Section V

THE TERMITES OF CANADA (ISOPTERA)

Termites (see Section VII), often called "white ants", live in colonies. Each colony is made up of at least three different forms or castes as follows: (1) the mature males and females or reproductive caste; these bear wings which are shed after mating has been accomplished; (2) the wingless worker caste; and (3) the soldier caste. Each caste has a particular function to perform in the social activities of the termite colony.

There are about 55 termite species in North America but four, only, are known to occur in Canada. Of these four species, only one is found east of British Columbia. The following keys to winged adults and soldiers will enable separation of the Canadian species.

Key to Winged Termites

1. Less than one inch long; wings with only one strong relatively simple vein, near the anterior margin (Fig. 1,a).....*Reticulitermes* spp.....2

   More than one inch long; wings with several strong veins anteriorly, one of which is much branched (Fig. 2,a); in Canada, found only in southern British Columbia.....*Zootermopsis* spp.....3

2. Ocellus less than its own diameter from the margin of the eye (Fig. 3,a); in Canada, found only in southern British Columbia.....
   .....*Reticulitermes hesperus* Banks

   Ocellus more than its own diameter from the margin of the eye (Fig. 4,a); in Canada, found only in southwestern Ontario (Fig. 5).....
   .....*Reticulitermes flavipes* (Koller)

3. Body pale yellowish; wings grey...*Zootermopsis angusticollis* (Gagen)

   Body darker; wings also darker (Fig. 6).....
   .....*Zootermopsis nevadensis* (Hagen)

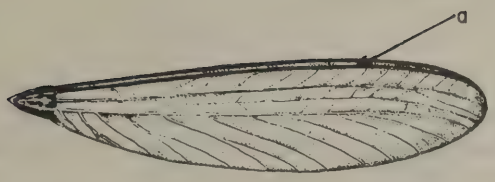
Key to Soldier Castes of Termites

1. About one-quarter inch (Fig. 8); labrum narrowing to a pointed tip (Fig. 7,a); mandibles without teeth (Fig. 7,b).....
   .....Reticulitermes spp.....2

   About three-quarter inch long (Fig. 10); labrum broad, truncate on tip (Fig. 9,a); mandibles with teeth (Fig. 9,b); in Canada found only in British Columbia.....*Zootermopsis angusticollis* (Hagen), and *Zootermopsis nevadensis* (Hagen)

2. Head fully twice as long as broad; in Canada found only in southern British Columbia.....*Reticulitermes hesperus* Banks

   Head less than twice as long as broad; in Canda found only in southwestern Ontario.....*Reticulitermes flavipes* (Kollar)



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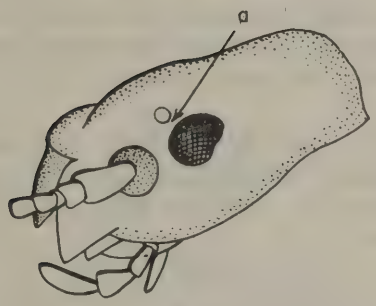

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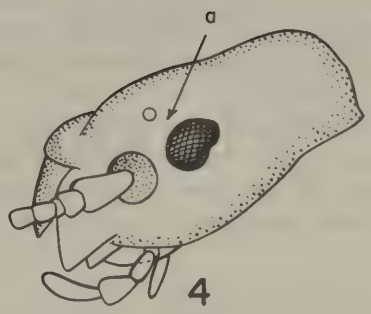

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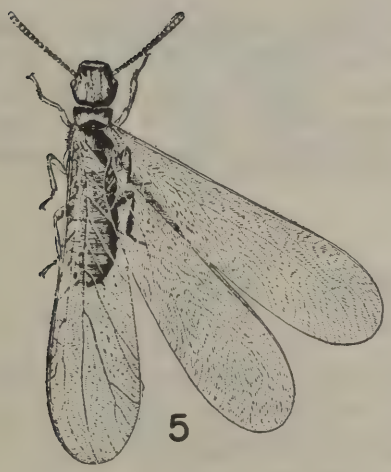

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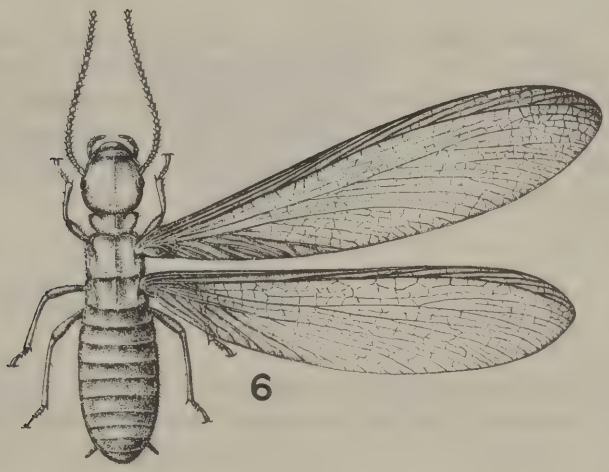

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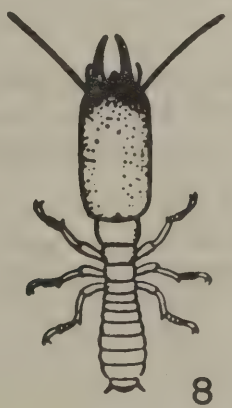

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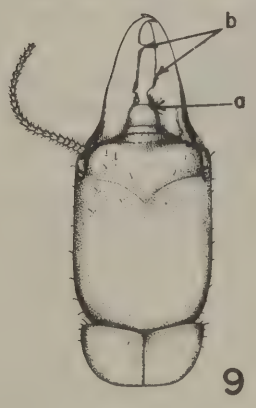

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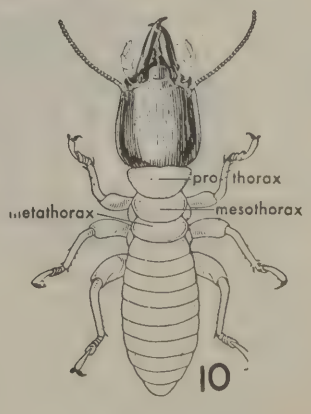

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LICE THAT LIVE ON MAN (ANOPLURA)

The three forms of lice that live on man (see Section IV), are equipped with mouthparts that enable them to pierce the skin and suck blood. They should not be confused with the bird or chewing lice (Mallophaga) which feed on the scurf and debris on the skin of birds and some mammals.

The head louse and body louse belong to the same species -- Pediculus humanus L. (Fig. 1) -- but the form found on the head is called a different "variety" -- P. humanus capitis DeG. -- from that found on the body -- P. humanus corporis DeG. The head louse is somewhat smaller in size, darker brownish colour and with shorter antennae than the body louse.

The public louse -- Phthirus pubis (L.) (Fig. 2) -- is a different species. Commonly called the "crab louse", it can usually be distinguished from the head and body louse, or "cooty", by its small size, slower movements, general appearance, and choice of location on the body.

BED BUGS OF ECONOMIC IMPORTANCE IN CANADA (HEMIPTERA : CIMICIDAE)

Three species of the bed bug family are commonly encountered in Canada (see Section IV). They can usually be distinguished from one another on the basis of where they are found. The common bed bug, Cimex lectularius L., is a parasite of man; the swallow bug, Oeciacus vicarius Horvath is a parasite of chimney swifts and swallows; the bat bug, Cimex pilosellus (Horvath) feeds on various kinds of bats.

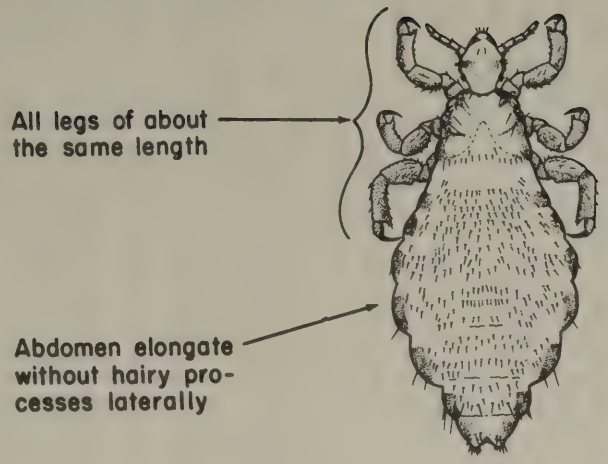
Key to the Bed Bugs of Canada

1. Anterior margin of pronotum almost straight, weakly concave (Fig. 3,a); occurs in the nests of chimney swifts and swallows.....
.....Oeciacus vicarius (Horvath)

   Anterior margin of pronotum deeply concave (Fig. 4,a); not associated with birds.....2

2. Inner margins of elytra (Fig. 5,b) shorter than the length of the scutellum (Fig. 5,c); parasites of human beings.....
.....Cimex lectularius L.

   Inner margins of elytra (Fig. 4,b) longer than the length of the scutellum (Fig. 4,c); parasites of bats.....
.....Cimex pilosellus (Horvath)


All legs of about the same length
Abdomen elongate without hairy processes laterally

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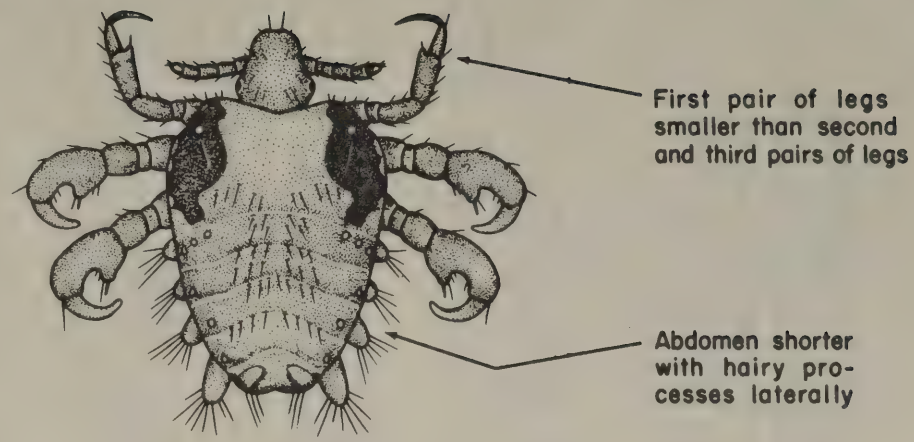
First pair of legs smaller than second and third pairs of legs
Abdomen shorter with hairy processes laterally

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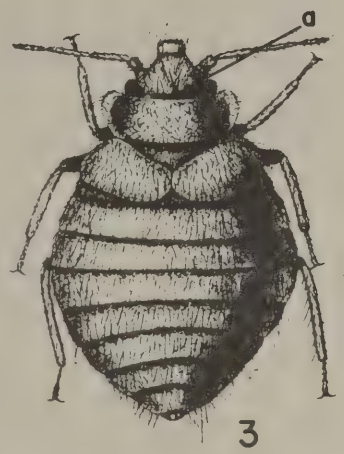
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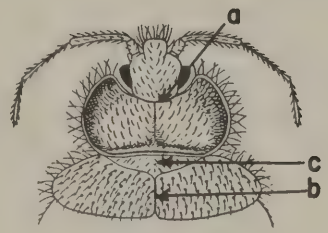
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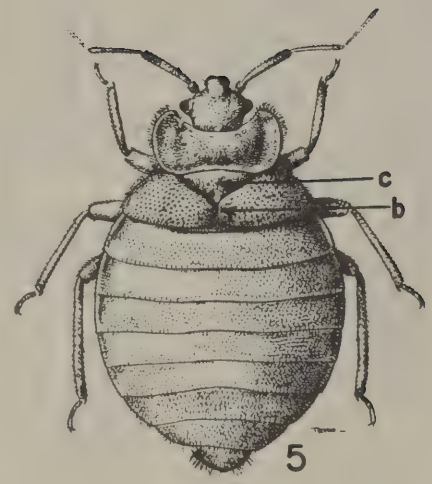
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MOTHS THAT INFEST STORED PRODUCTS IN CANADA (LEPIDOPTERA)

These keys are intended for the identification of species likely to be found in stored products in Canada[3] (see Section VI). There are thousands of similar species that have no direct connection with stored products, therefore a definite association of larvae with stored products is necessary before these keys can have any value. Even where such as association is definite, confirmation by an experienced person of the identity of the moth is desirable. Three species are omitted from the key to larvae because of absence of information on their structure.

The colours and wing-patterns of adult Lepidoptera are carried in minute, powder-like scales. These are easily rubbed off, destroying the diagnostic characters. Therefore, for successful use of the key to adults, undamaged specimens are required. Examination of larvae is best conducted in alcohol under a low-power stereoscopic microscope.

Certain terms used in the keys need explanation. The length of the fore wing (Fig. 1) is measured from base to apex, the width at right angles to this axis. The outer margin of the wing is the margin farthest from the base; the inner margin is the margin behind the long axis of the wing; the inner margins usually meet or overlap over the body when the moth is at rest. The wing consists of a scale-bearing membrane, beyond which extends a fringe of scales or hairs; in small Lepidoptera the fringe may be very long. The head (Fig. 2) of the adult usually bears compound eyes, antennae or feelers, and a coiled tongue or proboscis; the tongue is flanked on each side by a longer labial and a shorter maxillary palpus (plural palpi); the maxillary palpi may be wanting, but the labial palpi are always present.

The larva or caterpillar (Fig. 3) is divisible into a hard, glovular head, and a soft, segmented trunk. The first three segments of the trunk are the pro, meso, and meta-thorax. Each bears a pair of true legs. The remaining ten segments constitute the abdomen. The third to sixth and the tenth abdominal segments each bear on the ventral surface a pair of soft fleshy prolegs; the prolegs are armed ventrally with small, usually numerous hooks, called crochets. On each side of the prothorax and of abdominal segments one to eight is a small, oval or round breathing hole or spiracle; the rim of each spiracle is hardened or sclerotized, and is called the peritreme. The head of a caterpillar (Fig. 4) consists of two hemispheres separated in the mid-line by a longitudinal seam or suture, the coronal suture. Anteriorly, other sutures define a triangular front, flanked on each side by a strap-like adfrontal sclerite or plate. The posterior or dorsal margins of the adfrontals meet behind to form the vertical triangle. On each side of the head just above the mouth are typically six button-like simple eyes. In some species these are reduced in number or absent. Both head

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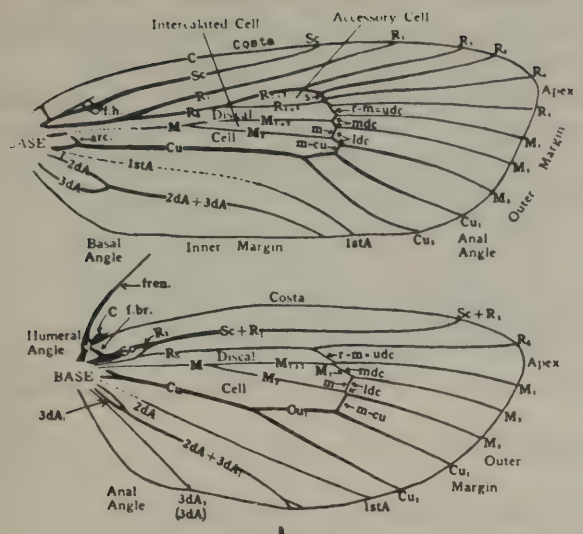
[3]For more extended treatments of the lepidopterous pests of stored products in the world consult: Corbet, A.S. and W.H.T. Tams (1943), "Keys for the identification of the Lepidoptera infesting stored food products", Proc. Zool. Soc. London Series B, Vol. 113, pp. 55-148; and Hinton, H.E., (1943) "The larvae of the Lepidoptera associated with stored products", Bull. Ent. Res., Vol. 34, pp. 163-212. Much of the information given here has been drawn from these two sources.



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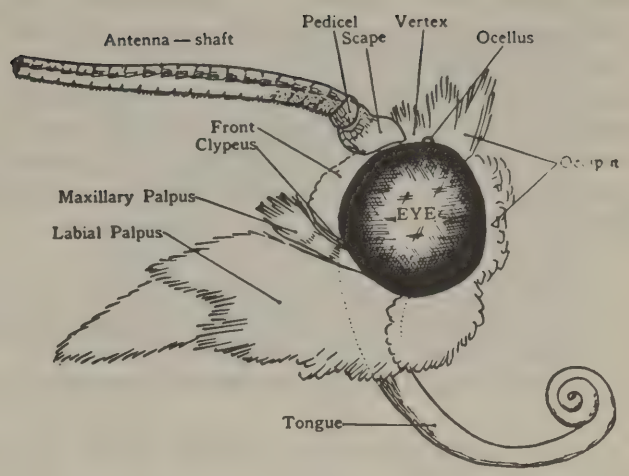
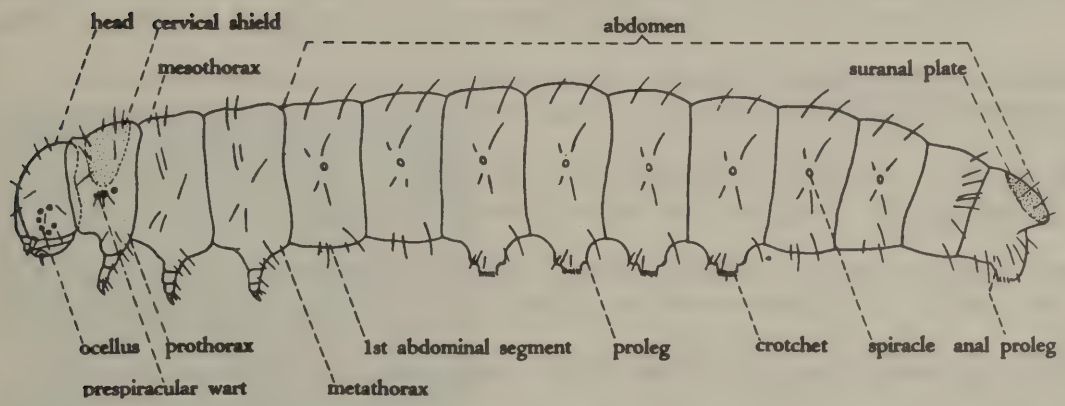


2

LATERAL ASPECT OF A CATERPILLAR



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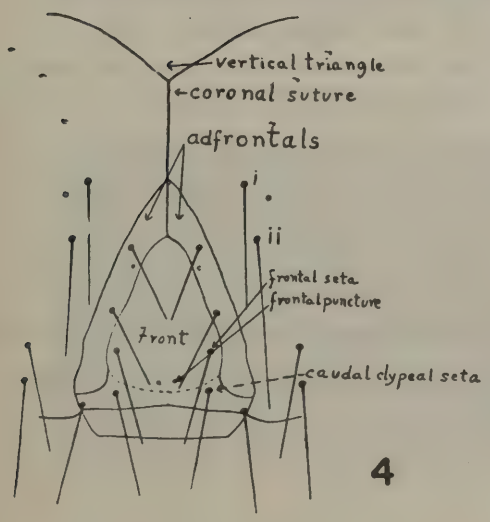

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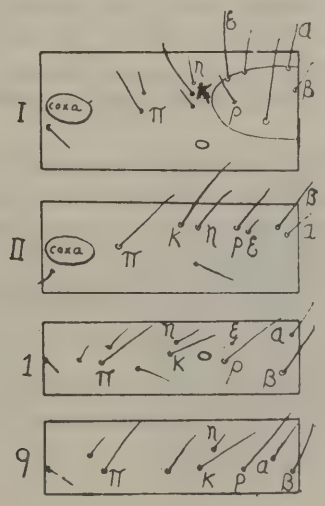

5

α---- alpha

β---- beta

ε---- epsilon

η---- eta

κ---- kappa

π---- pi

ρ---- rho

6

and trunk are sparsely clothed with long, slender, spine-like hairs, called setae. Each seta arises from a definite socket, so, even if it is knocked off, its position can usually be determined. Setae may arise from sclerotized patches in the skin, and are often associated in groups. The groups or patches may be termed unisetose, bisetose, etc., according to whether they include one, two, or more setae. The setae or groups of setae of the trunk occur in definite positions on each segment, and are designated in the system followed here by Greek letters (see above, Figs. 5,6).

Key to Adults

1. Fore wing less than three times as long as wide (Figs. 7, 8).....2

   Fore wing more than three times as long as wide (Figs. 12-16).....3

2. Basal and outer parts of fore wing purplish, middle part olive-buff, the three areas marked off by irregular whitish lines (Fig. 7). Larva in cereals.....meal moth, Pyralis farinalis L.

   Fore wing blackish, with indistinct reddish-buff markings (Fig. 8). Larva in maize and in grain refuse.....
   .....small tabby moth [4]*, Aglossa caprealis Hbn.

3. Labial palpi slender, pointed, upturned in a sickle-like curve to above the level of the top of the head (Fig. 9).....4

   Labial palpi extending straight out in front or upturned but not reaching the level of the top of the head (Figs. 10, 11).....6

4. Fore wing pale buff, unmarked (Fig. 12). Larva feeding internally in grain.....Angoumois grain moth, Sitotroga cerealella Oliv.

   Fore wing dark brown or marked with blackish.....5

5. Membrane of fore wing almost symmetrical about an axis from base to apex, outer and inner margins hardly distinguishable (Figs. 13, 15). Larva in stored cereals, dried fruit, and dried animal and vegetable matter.....
   .....white-shouldered house moth*, Endrosis sarcitrella (L.)

   Membrane of fore wing markedly asymmetrical about an axis from base to apex, an inner and an outer margin being clearly distinguishable postaxially (Figs. 14, 16). Larva in stored cereals, dried fruit, and dried animal and vegetable matter.....
   .....brown house moth, Hofmannophila pseudospretella (Staint).

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[4]Common names marked with an asterisk are drawn from sources other than Muesebeck's list, and have no equivalents therein.

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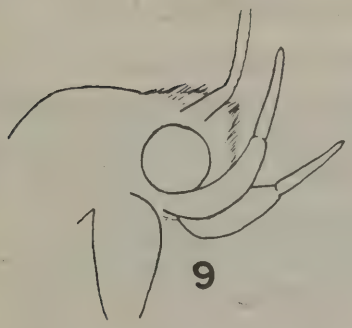

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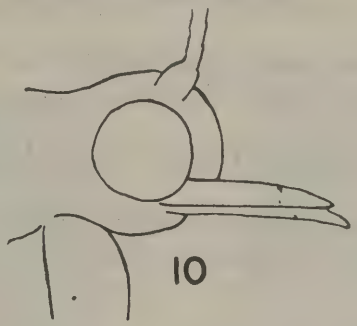

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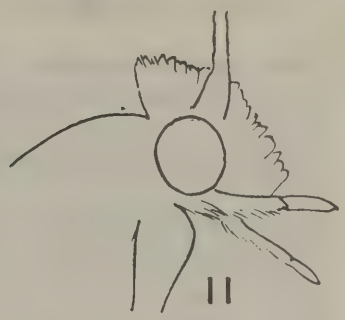

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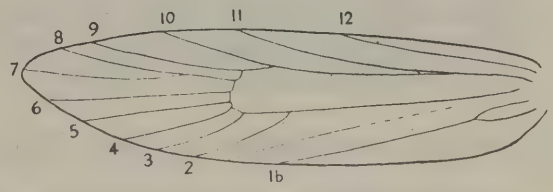

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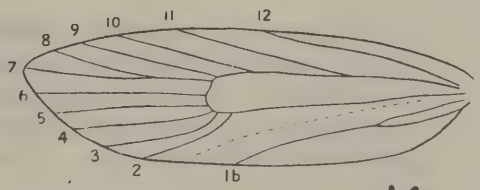

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6. Basal and outer parts of fore wing sharply contrasting in colour (Figs. 17, 18).....7

Basal and outer parts of fore wing of about the same colour (Figs. 19, 20).....8

7. Basal part of fore wing pale buff, outer part purplish (Fig. 17). Larva in dried fruits, cereals, nuts, and other dried vegetable and animal matter..... .....Indian-meal moth, Plodia interpunctella (Hbn.)

Basal part of fore wing blackish, outer part pale buff (Fig. 18). Larva in carpets, clothing, furs and other dried vegetable and animal matter.....carpet moth, Trichophage tapetzella (L.)

8. Fore wing blackish, irregularly striated, and with a small pale spot near the middle (Figs. 19, 20).....9

Fore wing light grey or brown (Figs. 24, 25).....10

9. Fore wing with pale spot before middle, inner margin concolorous (Fig. 19). Larva in dried animal matter..... .....Monopis rusticella (Clerck)

Fore wing with pale spot at middle, inner margin contrastingly pale (Fig. 20). Larva in seeds, dried vegetable matter, and clothing..... .....Monopis crocicapitella (Clem.)

10. Labial palpi upturned (Fig. 21).....11

Labial palpi directed forward or downward (Figs. 22, 23).....14

11. Fore wing with a narrow, womewhat irregular, transverse pale band near outer margin, defined on each side by a continuous, though rather indistinct, darker band (Fig. 24). Larva in dried fruit, cacao, nuts and seeds, grain, and other dried vegetable material; less often, in dried material.....tobacco moth, Ephestia elutella (Hbn.)

Fore wing with a well-defined, dark-bordered band near outer margin....12

12. Fore wing with transverse band before the middle, straight, continuous, dark, and basally bordered with pale scales (Fig. 25). Larva mainly in dried fruits, but also in cereals, meal, nuts, and seeds.....almond moth, Ephestia cautella (Wlk.)

Fore wing with transverse band before the middle curved or angled.....13

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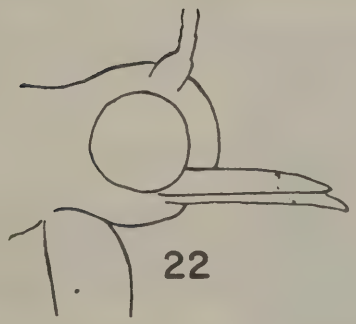

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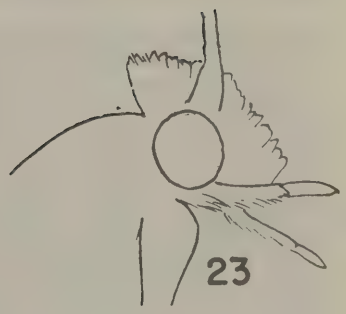

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13. Fore wing with transverse band before the middle zig-zagged and irregular (Fig. 26). Larva in flour and meal, nuts,„etc.....
.....Mediterranean flour moth, Ephestia kuhniella Zell.

Fore wing with transverse band before the middle curved but not zig-zagged (Fig. 27). Larva in dried fruit and meal.....
.....raisin moth, Ephestia figulilella Greg.

14. Wings dull mouse-grey; fore wing with minute longitudinal dark streaks, but otherwise unmarked (Fig. 29). Larva in dried fruit, seeds, and rice.....Corcyra cephalonica (Staint.)

Wings pale buff, or shining greyish-buff.....15

15. Fore wing with a small but conspicuous dark spot beyond middle, and a pale band near to and paralleling outer margin. Length of fore wing over one-third inch (Fig. 29). Larva in seeds and nuts.....
.....Aphomia gularis (Zell.)

Fore wing without a pale band near outer margin, and with at most a minute dark dot beyond middle. Length of fore wing under one-quarter inch.....16

16. Tongue present; fore wing with a dark dot beyond middle (Fig. 30). Larva in clothes, making a portable case, and in other dried animal and vegetable material.....
.....casemaking clothes moth, Tinea pellionella L.

Tongue absent; fore wing unicolorous (Fig. 31). Larva webbing in clothes and dried animal matter, occasional in cereals.....
.....webbing clothes moth, Tineola bisselliella (Hum.)

Key to Larvae[5]

1. Prolegs short, narrow, often very indistinct, each with two to four crochets (Figs. 32, 33). Inside grain except in first instar.....
.....Angoumois grain moth, Sitotroga cerealella Oliv.

Prolegs distinct and well developed and each proleg always with man crochets (Fig. 34).....2

2. Kappa group of prothorax bisetose (Fig. 35).....3

Kappa group of prothorax trisetose (Fig. 36).....10

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[5]Adapted from Hinton, 1943.

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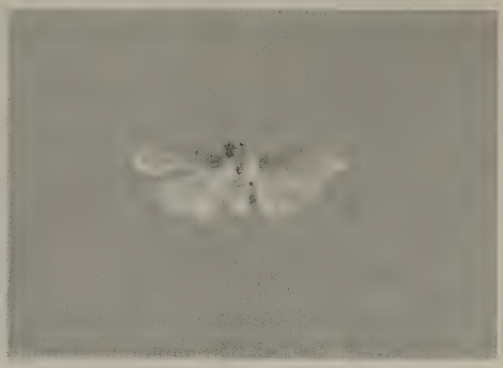

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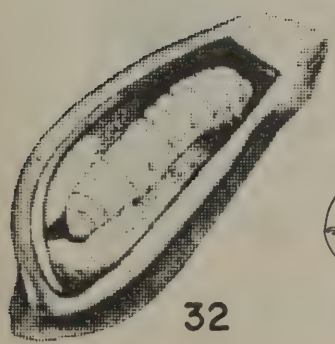

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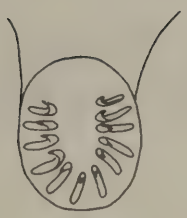

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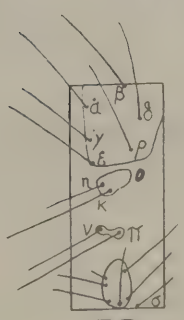

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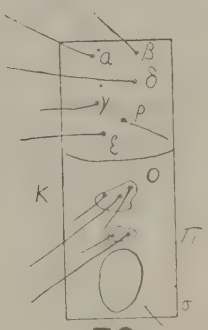

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3. First abdominal segment with a sclerotized ring (Fig. 37,a) enclosing a membranous area around base of seta rho.....4

First abdominal segment without a sclerotized ring enclosing a membranous area around base of seta rho.....5

4. Head with boundaries of adfrontals joining coronal suture (Fig. 38,a) about half way between front (Fig. 38,b) and vertical triangle (Fig. 38,c). Abdominal spiracles with caudal and anterior part of peritreme about equal in thickness (Fig. 39,a). Each of setae, alpha, beta, rho, and kappa of first seven abdominal segments usually arising from a distinct sclerotized area (Fig. 39,b). In seeds and nuts.....Aphomia gularis (Zell.)

Head with boundaries of adfrontals joining coronal suture (Fig. 40,a) at a point about twice as far from front (Fig. 40,b) as from vertical triangle (Fig. 40,c). Spiracles with caudal part of peritreme one and one-half to two times as thick as anterior part (Fig. 41,a). Setae alpha, beta, rho, and kappa of first seven abdominal segments with at most very indistinct sclerotized areas at base (Fig. 41,b). In dried fruits, seeds, and rice.....
.....Corcyra cephalonica (Staint.)

5. Mesothorax with a sclerotized ring enclosing a membranous area around base of seta rho (Fig. 42,a).....6

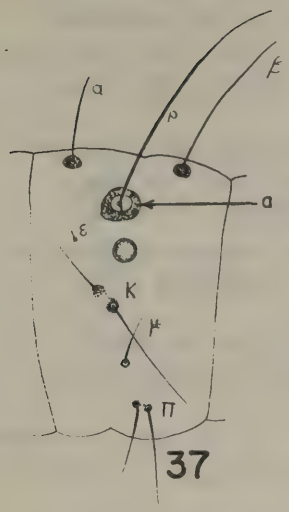
Mesothorax with no sclerotized ring around base of seta rho (Fig. 43,a).9

6. Head with front extending two-thirds distance to vertical triangle (Fig. 44). Abdominal setae of first nine segments not arising from sclerotized patches, though rho of eighth is surrounded by a sclerotized ring (Fig. 45). Larva (Fig. 46) in dried fruits, cereals, nuts, and other dried vegetable and animal matter.....
...Indian-meal moth, Plodia interpunctella (Hbn.)

Head with front extending at most slightly more than half distance to vertical triangle (Fig. 47). Most or all dorsal and lateral abdominal setae arising from distinctly sclerotized patches (Figs. 48,49).....7

7. Eighth abdominal segment with seta epsilon (Fig. 48,a) separated from spiracle (Fig. 48,b) by a distance at most, very slightly more than diameter of spiracle. Mainly in dried fruits; also in cereals, meal, muts and seeds.....
.....almond moth, Ephestia cautella (Wlk.)

Eighth abdominal segment with seta epsilon (Fig. 49,a) separated from spiracle (Fig. 49,b) by a distance equal at least to nearly twice diameter of spiracle.....8



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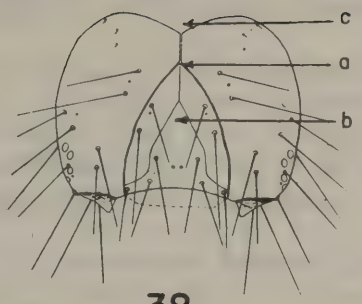

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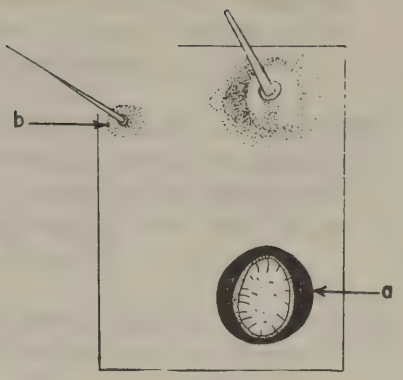

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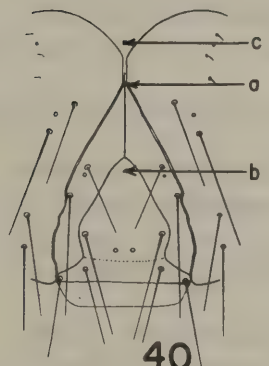

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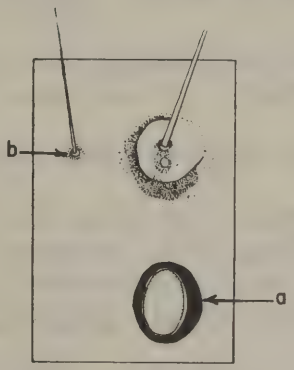

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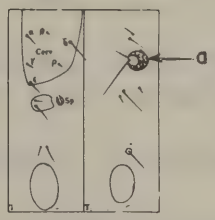

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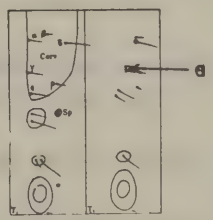

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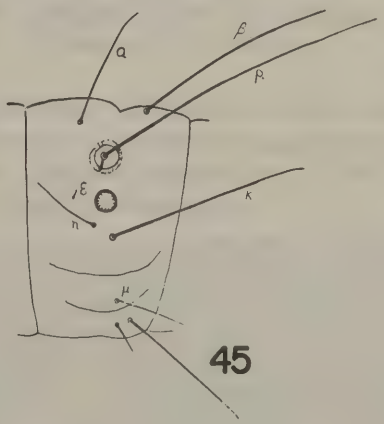

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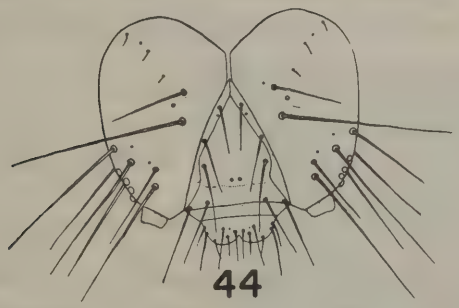

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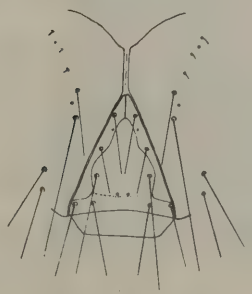

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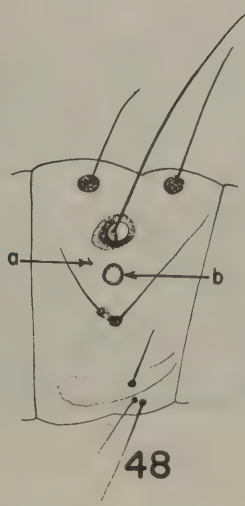

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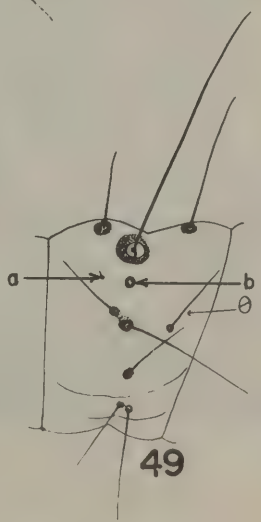


49

8. Eighth abdominal segment with spiracle (Fig. 50,a) as broad as or broader than membranous area (Fig. 50,b) enclosed by sclerotized ring around base of seta rho. In flour and meal, nuts, etc.....
.....Mediterranean flour moth, Ephestia kuhniella Zell.

Eighth abdominal segment with spiracle (Fig. 51,a) at the most two-thirds as broad as membranous area (Fig. 51,b) enclosed by sclerotized ring around base of seta rho. In dried fruit, cacao, nuts, and seeds, grain, or dried animal matter.....
.....tobacco moth, Ephestia elutella (Hbn.)

9. Pi group of ninth abdominal segment unisetose (Fig. 52). In stored cereals and cereal refuse.....meal moth Pyralis farinalis L.

Pi group of ninth abdominal segment bisetose (Fig. 53). In grain refuse and corn.....small tabby moth*, Aglossa caprealis (Hbn.)

10. Setae kappa and eta of abdominal segments close together and often on the same sclerotized plate.....11

Setae kappa and eta of abdominal segments very widely separated.....12

11. Head with four simple eyes on each side (Fig. 54); pi group of first abdominal segment bisetose (Fig. 55). In stored cereals, dried fruit, and dried animal and vegetable matter.....
..brown house moth*, Hofmannophila pseudospretella (Staint.)

Head with two simple eyes on each side (Fig. 56); pi group of first abdominal segment trisetose (Fig. 57). In stored cereals, dried fruit, and dried animal and vegetable matter.....
....white-shouldered house moth*, Endrosis sarcitrella (L.)

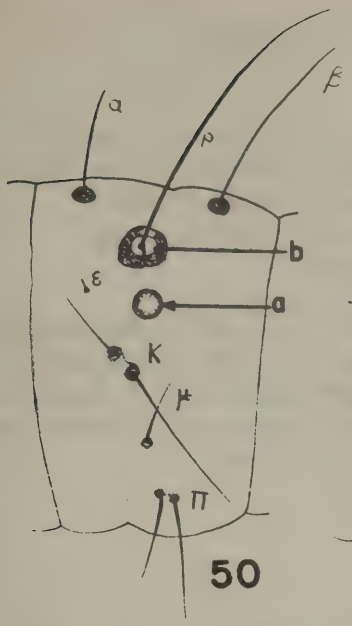
12. Eyes lacking (Fig. 58). Webbing in clothes, dried animal matter, occasionally in cereals.....
.....webbing clothes moth, Tineola bisselliella (Hum.)

Head with one distinct eye (Fig. 59,a) on each side.....13

13. Setae kappa and eta of first eight abdominal segments in a nearly vertical line, with kappa dorsad of eta, and nearly directly caudad of spiracle. In carpet, clothing, furs, and other dried animal and vegetable matter.....carpet moth, Trichophaga tapetzella (L.)

Setae kappa and eta of first eight abdominal segments in a nearly horizontal line, with kappa considerably below spiracle. In clothes, making a portable case, and in other dried animal and vegetable matter (Fig. 60).....
.....casemaking clothes moth, Tinea pellionella (L.)

The following species are omitted from the key to larvae:
The raisin moth, Ephestia figulilella Greg. Larva in dried fruit and meal.
Monopis crocicapitella (Clem.). Larva in seeds, dried vegetable matter and clothing.
Monopis rusticella (Clerck). Larva in dried animal matter.



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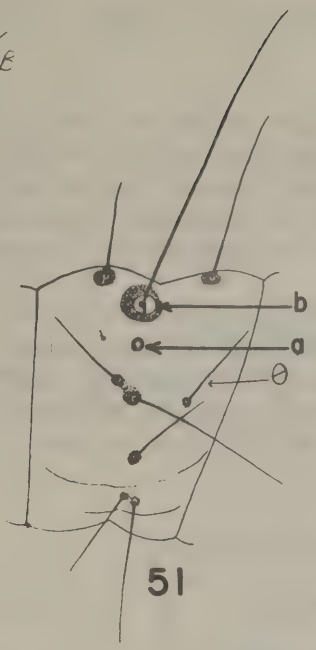

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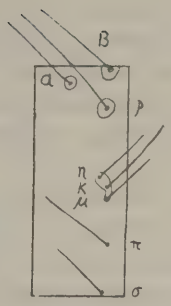

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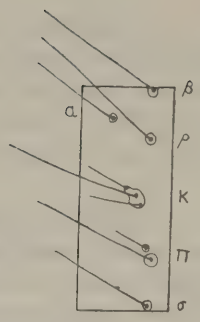

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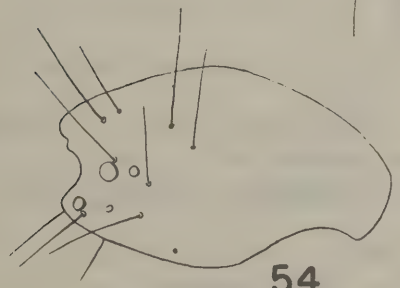

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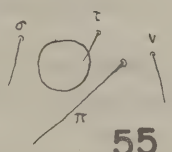

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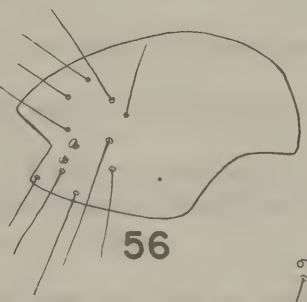

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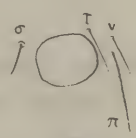

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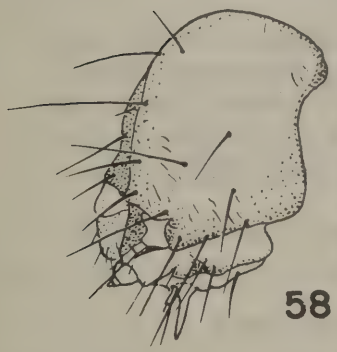

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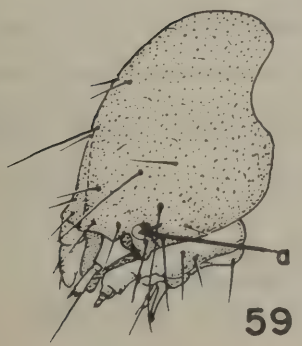

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A great many kinds of beetles are known to live in and destroy food, fabric and wood products. Some are primary pests, others are either incidental, or come in at a late stage in the general breakdown of the stored materials. The key has been limited to the more important species (see Sections VI and VII) that affect these products in Canada[6].

Unlike moths, beetles of stored products are usually found in association with their immature stages. Since this is so and because of the difficulty in constructing a usable key to the immature stages of these beetles, no separate key has been prepared for identification of the larvae. However, illustrations of the developmental stages of most of the species are provided.

Key to Beetles

1. Length one-quarter inch or greater.....2

   Length rarely almost one-quarter inch.....9

2. Upper side yellow, the wing covers tipped with black (Fig. 1). Length three-eighths to one-half inch. Larva in moist wood.....
   .....wharf borer, Nacerdes melanura (L.)

   Upper side largely or entirely brown or black, the tips of the wing covers never darker than some of the other parts.....3

3. Antennae strongly elbowed at the end of the first segment; first segment almost as long as the other segments united; antennae arising near the tip of a short, blunt beak (Fig. 2). Larvae living on roots; adults sometimes invading buildings in large numbers.....
   .....snout beetles, Brachyrhinus spp.

   Antennae not elbowed, the first segment much shorter than the others combined. Head not produced into a beak.....4

4. Body, above and beneath, with fine pale hairs, which form a pattern on the upper side.....5

   Body, above and beneath, lacking hairs, lacking any pattern.....7

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[6]For more extended treatments of Coleoptera of economic importance consult:

Good, N.E., 1936, "The flour beetles of the genus Tribolium", U.S.D.A. Tech. Bull. 498: 1-58.

Hinton, H.E., 1945, "A monograph of the beetles associated with stored products", Vol. 1, 443 pp: British Museum (Natural History)London.

Hinton, H.E., 1941, "The Ptinidae of economic importance", Bull. Ent. Res. 31: 331-381.

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5. Thorax widest at middle. Antennae about half as long as the body, not enlarged at their tips. Whitish hairs condensed on the sides of the thorax and forming patches on the wing covers at their middle (Fig. 3). Length three-eighths to three-quarters of an inch. Larva in wood .....old house borer, Hylotrupes bajulus (L.)

Thorax widest at base. Antennae much shorter, strongly clubbed (Figs. 5, 7). Length one-quarter to one-half inch. Larva brown, hairy (Figs. 4, 6). In cured meats and dry animal matter generally.....6

6. Basal half or two-fifths of wing covers clay-coloured, except for a few small black spots, because of fine, pale hairs; the posterior half black, with fine, black hairs; the tips of the wing covers unarmed (Figs. 4,5).....
.....larder beetle, Dermestes lardarius L.

Wing covers entirely black; usually with very sparse, pale hairs throughout; the tip of each wing cover minutely saw-toothed and with a small spine. Thorax black, but with pale hairs condensed along each side (Figs. 6, 7).....
.....hide beetle, Dermestes maculatus DeG.

7. Thorax widest at middle, its sides evenly curved. Front tibiae curved. Length one-half to five-eighths of an inch (Figs. 11, 12). Larva hard, polished, cylindrical (Fig. 10). In cereals that are damp and in poor condition (mealworms).....8

Thorax more strongly narrowed posteriorly, much narrower posteriorly than near the head, the body therefore constricted. Front tibiae straight. Length one-quarter to one-half inch (Fig. 9). Larva soft, whitish; head, spots on thorax, and two spines at posterior end blackish (Fig. 8). In grain and ground cereals generally.....
.....cadelle, Tenebroides mauritanicus (L.)

8. Wing covers simply punctate; the punctures fine, well separated (Fig. 11). Larva yellow (Fig. 10).....
.....yellow mealworm, Tenebrio molitor L.

Wing covers roughened but without distinct, separated punctures (Fig. 12). Larva dark brown.....
.....dark mealworm, Tenebrio obscurus Fab.

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9. Antennae strongly elbowed at the end of the first segment, which is at least half as long as the other segments united. Head more or less produced into a beak (Figs. 13, 14, 16).....10

Antennae not elbowed, the first segment (Figs. 19-23) much shorter....12

10. Beak robust, equal in length to the remainder of the head, the antennae arising near its tip. Wing covers and thorax strongly curved on each side. Length at least three-sixteenths of an inch (Fig. 13). Larvae living on roots; adults sometimes invading buildings in large numbers.....
.....snout beetles, Brachyrhinus, various species

Beak slender, longer than the remainder of the head, the antennae arising from its base. Sides of the body almost parallel (Figs. 14, 16). Larva short and very robust, legless, whitish (Fig. 15). Breeding in whole grain and in solidified farinaceous material 11

11. Punctures of the thorax distinctly longer than wide. Brown throughout; the wing covers lacking spots, but with fine grooves that are separated by distances much greater than the width of the grooves. Length one-eighth inch or a trifle greater (Fig. 14).....
.....granary weevil, Sitophilus granarius (L.)

Punctures of the thorax not or scarcely longer than wide. Brown or blackish; each wing cover usually with a pale spot at base and another near tip. Wing covers with rows of punctures, which are separated by ridges that are narrower than the punctures. Length one-eighth inch (Fig. 16).....
.....rice weevil, Sitophilus oryza (L.)

12. Entire body blue or blue-green, the legs pale red. Length three-sixteenths of an inch (Fig. 18). Larva brownish, hairy (Fig. 17). In cured meats and other animal matter.....
.....red-legged ham beetle, Necrobia rufipes (DeG.)

Differently coloured.....13

13. Antennae threadlike, never clubbed or gradually enlarged toward the tip; always quite visible. General colour brown or yellow (Figs. 19, 20).....14

Antennae variable but never threadlike; clubbed (Fig. 21), gradually enlarged to tip (Fig. 22), or saw-toothed (Fig. 23); sometimes concealed beneath the body.....19

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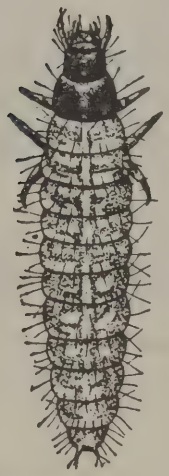

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14. Body above flat, with very inconspicuous hairs. Thorax with a very fine ridge, extending from base to tip, on each side. Length one-sixteenth of an inch or a trifle greater (Fig. 24). Larva very small, flat, whitish. Usually in grain; occasionally in ground cereals (grain beetles).....15

Body convex above, with conspicuous hair (Figs. 25, 27, 28). Larvae stout, curved, hairy, and whitish. In cereals and other foods (spider beetles).....16

15. Some specimens (males) with the antennae at least three-fourths as long as the body (Fig. 24).....
.....a grain beetle, Laemophloeus turcicus Grouv.

Antennae never more than half as long as the body.....
....rusty grain beetle, Laemophloeus ferrugineus (Steph.)

16. Integument of the body above virtually concealed by hair. Wing covers lacking spots (Figs. 25, 27).....17

Integument of body above quite visible, the hairs numerous but sparse. Wing covers with patches of white scales near their base and tip (Fig. 28).....18

17. The entire insect golden yellow. Wing covers, viewed from above, almost circular. Length one-eighth to three-sixteenths of an inch (Fig. 25).....
.....golden spider beetle, Niptus hololeucus (Fald.)

The entire insect brown. Wing covers, viewed from above, distinctly longer than wide. Length one-eighth inch (Fig. 27).....
.....Australian spider beetle, Ptinus ocellus Brown

18. Mid-line of thorax deeply impressed and with a conspicuous tuft of very dense hairs on each side (Fig. 26). Hairs of the wing covers virtually equal in length.....Ptinus raptor Sturm

Mid-line of thorax not impressed but apparently feebly so in some specimens because of the position of the hairs; hairs of the tufts not more dense than those of adjacent parts of the thorax. Hairs of the wing covers very unequal (Fig. 28).....
.....hairy spider beetle, Ptinus villiger (Reit.)

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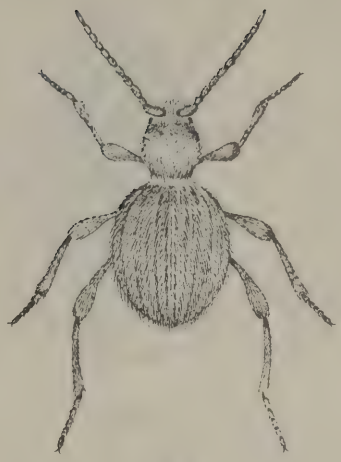

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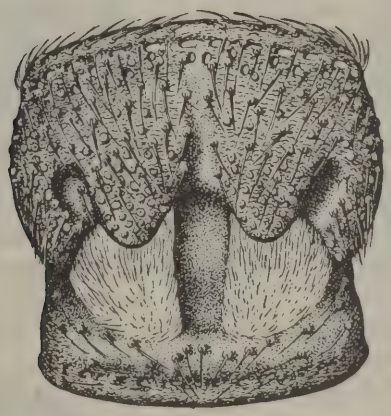

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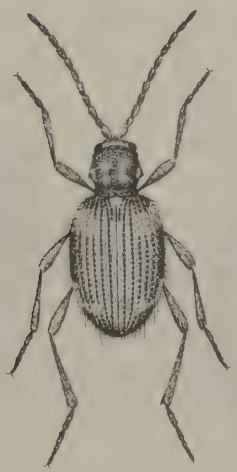

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19. Abdomen at tip with large, oblique area that is not covered by the wing covers. Wing covers flattened, blackish but variegated with white hairs. Antennae gradually enlarged to tip, not clubbed (Fig. 30, 32).....20

Abdomen entirely covered by the wing covers or with the tip briefly exposed. Variegated species have clubbed antennae (Figs. 34,36, 38).....21

20. Thorax with a tooth on each side at middle, this sometimes obscured by hair. Front and middle legs partly black. Length three-sixteenths of an inch or a trifle less (Fig. 30). Larvae whitish (Fig. 29), living within peas and leaving circular emergence holes in them.....pea weevil, Bruchus pisorum (L.)

Thorax lacking teeth. Front and middle legs entirely pale. Length one-eighth inch (Fig. 32). Larvae whitish (Fig. 31), living within dried beans and leaving circular emergence holes in them .....bean weevil, Acanthoscelides obtectus (Say)

21. Broadly and evenly oval, the sides of the thorax continuous with those of the wing covers. Above, blackish or distinctly variegated with pale hairs or scales 22

Body never at the same time broadly and evenly oval and blackish; never varicoloured.....26

22. Entirely blackish; with inconspicuous hairs that do not form a pattern. Length one-eighth to three-sixteenths of an inch (Fig. 34). Larva brown, hairy, lacking hair tufts but with a pencil of hairs at the posterior end (Fig. 33). In dry animal products, especially woollens; in grain and cereals..... .....black carpet beetle, Attagenus piceus (Oliv.)

Distinctly variegated above.....23

23. General colour blackish. Wing covers with reddish streaks that are covered with fine, white hairs; their surface lacking scales, not hidden by the hairs. Length one-sixteenth to almost three-sixteenths of an inch (Fig 36). Larva brownish, with prominent hair tufts posteriorly and with a pencil of hairs at the posterior end (Fig. 35). In many kinds of dry animal and vegetable products, including dried milk.....larger cabinet beetle, Trogoderma inclusum Lec.

Body surface completely hidden, or virtually so, by variegated scales; lacking fine hairs. Length one-sixteenth to one-eighth inch (Fig. 38). Larvae brownish, hairy, with prominent hair tufts posteriorly, lacking distinct hair pencils (Fig. 37). In dry animal matter, including woollens (carpet beetles).....24

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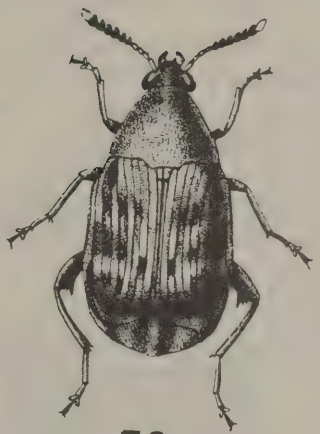

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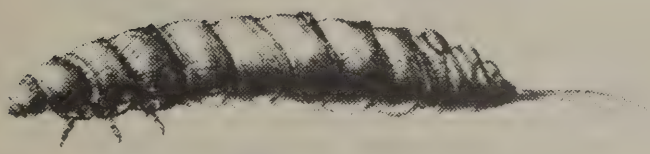

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24. Black, white, and red above; the red scales forming a conspicuous, longitudinal stripe along the middle of the wing covers (Figs. 39,40).... .....carpet beetle, Anthrenus scrophulariae (L.)

Black, white, and yellow above; lacking red scales.....25

25. Scales of the wing covers slender, two and one-half to four times as long as broad. Cavities, which receive the antennae on the underside of the thorax, occupying about half the length of the sides of the thorax (Figs. 41, 42).....

Scales of the wing covers broadly oval, twice or less than twice as long as broad. Antennal cavities occupying about one-third of the length of the sides of the thorax (Figs. 43, 44)..... .....furniture carpet beetle, Anthrenus flavipes Lec.

26. Head received into the underside of the thorax; not visible from above and the antennae hidden beneath the body when the beetles feign death. Antennae saw-toothed or with the three terminal segments each at least twice as long as wide and together as long or longer than the other segments united. Body, viewed from above, apparently cylindrical. Larva stout, curved, hairy, whitish.....27

Head anterior, quite visible from above. Antennae not hidden; not saw-toothed; the terminal segments not or scarcely longer than wide, usually forming a club. Body moderately convex, never cylindrical.....29

27. Wing covers striate with rows of punctures. Antennae not saw-toothed, the terminal segments much longer than wide (Figs. 48, 50).....28

Wing covers lacking rows of punctures, virtually smooth. Antennae saw-toothed, the terminal segments not elongated. Length three-thirty-seconds to one-eighth inch (Figs. 45, 46). In dry vegetable products of many kinds..... .....cigarette beetle, Lasioderma serricorne (F.)

28. Thorax with a distinct elevation at middle near base. Body beneath, between and behind the middle legs, with a deep excavation. Length one-eighth inch or a trifle more or less (Figs. 47, 48). In wood.....furniture beetle, Anobium punctatum (DeG.)

Thorax lacking an elevation, strongly but evenly convex. Body not excavated beneath. Length three-thirty-seconds to one-eighth of an inch (Figs. 49, 50). In dry vegetable products of many kinds ..... drug-store beetle, Stegobium paniceum (L.)

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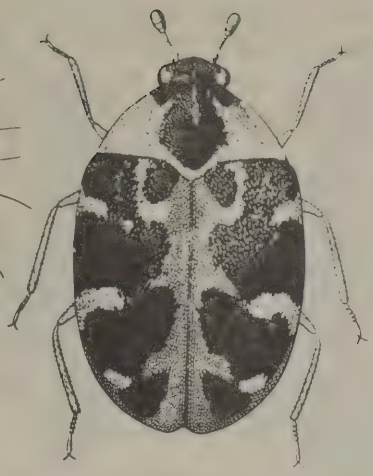

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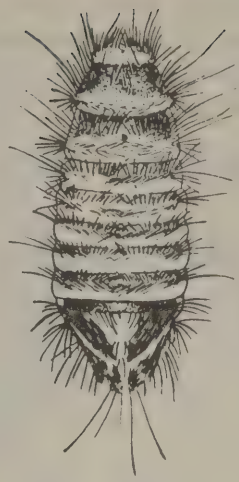

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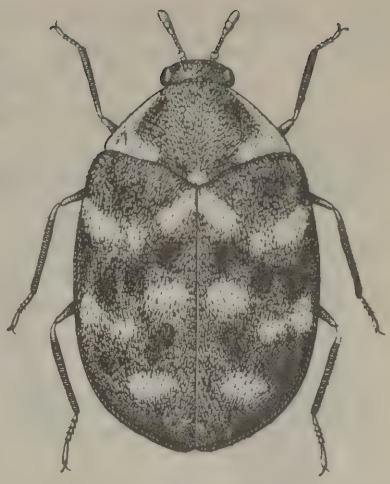

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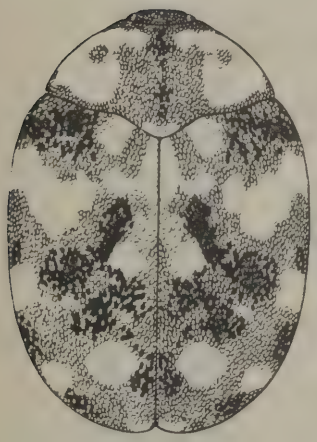

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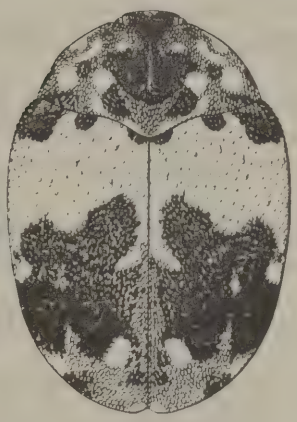

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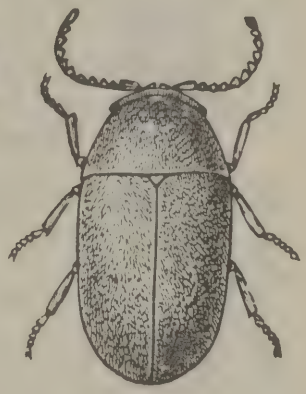

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29. Thorax distinctly longer than wide, with six strong teeth on each side. Reddish-brown. Length three-thirty-seconds inch (Figs. 51,52). In vegetable products of many kinds.....
.....saw-toothed grain beetle, Oryzaephilus surinamensis (L.)

Thorax not longer than wide, lacking conspicuous teeth.....30

30. Thorax three-fifths as wide as the wing covers, which are broadly rounded on the sides. Reddish-yellow to blackish. Length one-sixteenth inch (Fig. 53). In grain and cereals that are damp.....
.....Lathridius minutus (L.)

Thorax wider, almost or fully as wide as the wing covers, which are more elongate and less rounded on the sides.....31

31. Very dark brown or blackish. Body four times as long as wide. Each antenna terminating in a distinct, two-segmented club. Length one-eighth to three-sixteenths of an inch (Figs. 54-56). Boring in hardwoods.....southern lyctus beetle, Lyctus planicollis Lec. and other Lyctus spp.

Pale reddish-brown or reddish yellow. Body not more than three times as long as wide. Antennae gradually enlarged to tip or with three-segmented clubs. In grain and cereals.....32

32. Body above with fine, golden hairs. In vegetable products that are damp.....33

Body above lacking hairs. In ground cereals generally.....35

33. Anterior angles of thorax produced and prominent or thickened (Figs. 59, 61).....34

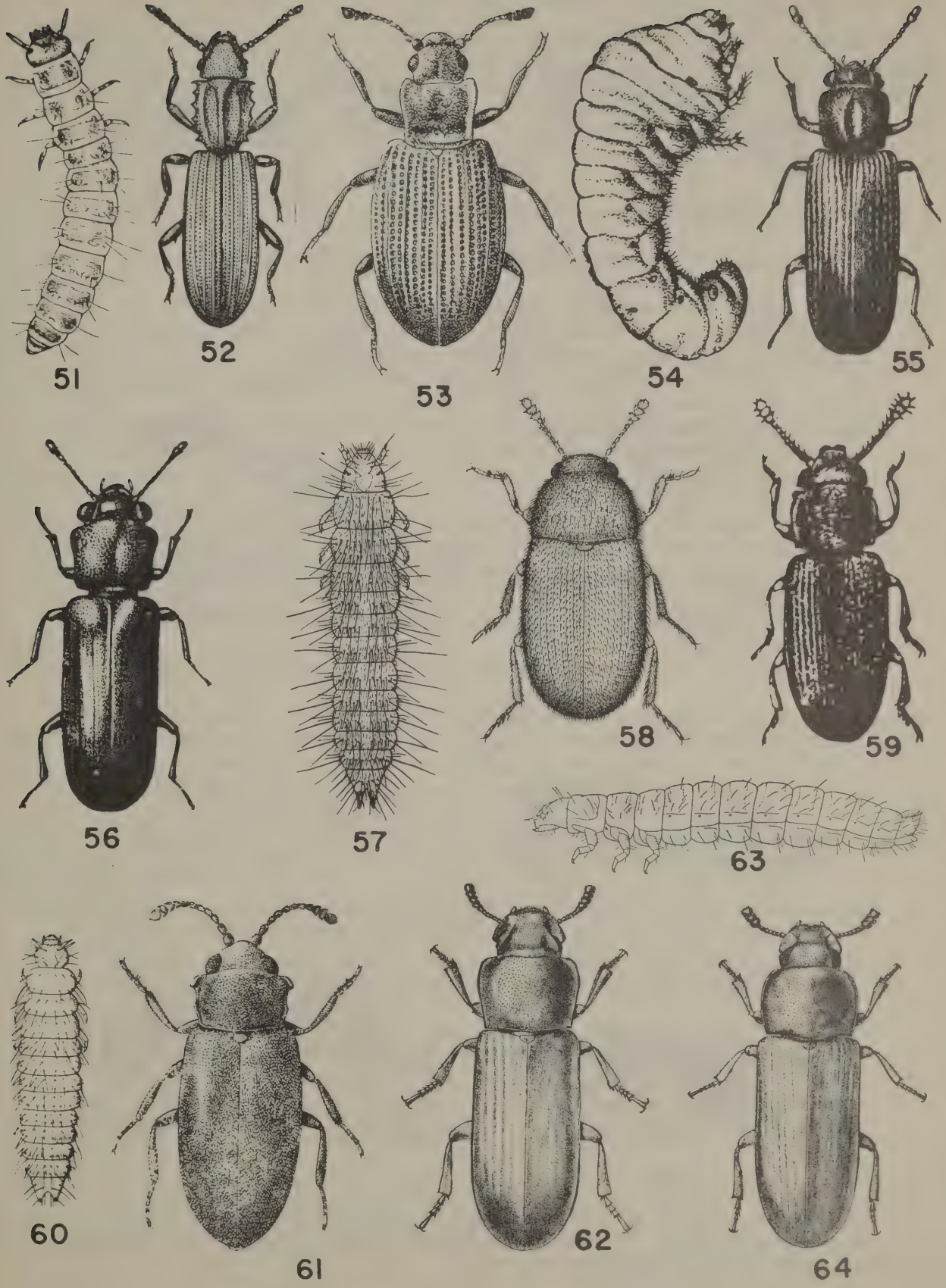
Anterior angles of thorax simple. Body more compact and more evenly oval. Length three-thirty-seconds of an inch (Figs. 57, 58).....
.....hairy fungus beetle, Typhaea stercorea (L.)

34. Anterior angles of thorax produced, prominent; the sides of the thorax simple. Length one-sixteenth inch (Fig. 59).....
.....foreign grain beetle, Ahasverus advena (Walt.)

Anterior angles of thorax thickened; the sides of the thorax often feebly undulate, often with a very small tooth at middle. Length one-eighth to three-thirty-seconds inch (Figs. 60, 61).....
.....Cryptophagus spp.

35. Each antenna gradually widened to tip, lacking an abruptly formed club. Head distinctly wider immediately in front of the eyes than across the eyes. Length one-eighth to five-thirty-seconds inch (Fig. 62).....confused flour beetle, Tribolium confusum Duv.

Each antenna with an abruptly formed, three-segmented club at tip. Head not wider before the eyes, although the cheeks are promiment there. Length one-eighth to five-thirty-seconds inch (Figs. 63, 64)
.....red-flour beetle, Tribolium castaneum (Hbst.)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ANTS OF ECONOMIC IMPORTANCE IN CANADA (HYMENOPTERA : FORMICIDAE)

There are about 100 different kinds of ants known in Canada[7]. Approximately one-tenth of these are pest species (see Section VII). They may be identified by the following characters and habits:

Key to Ants

1. With two segments between abdomen and thorax (Fig. 1).....2

   With one segment between abdomen and thorax (Fig. 8).....4

2. Antennae with ten segments, the last two forming a distinct club about one-sixteenth inch long; colour golden yellow (Fig. 1); usually found in dwellings; normally nesting outdoors.....
   .....thief ant, Solenopsis molesta (Say)

   Antennae with twelve segments, the last three forming a distinct club one-twelfth to one-tenth inch long; colour reddish-yellow or brownish-black (Fig. 2).....3

3. Head and thorax rough and dull; colour reddish-yellow; always found in dwellings where it builds its nest .....
   .....Pharaoh's ant, Monomorium pharaonis (L.)

   Head and thorax smooth and shining; colour brownish-black; may or may not nest in dwellings (Figs. 2, 3).....
   .....little black ant, Monomorium minimum (Buck.)

4. Anal opening slit-like and bare (Fig. 4); segment between the thorax and the abdomen obscure (Fig. 5); sometimes found in dwellings, more often out-of-doors under stones, logs, and boards.....
   .....odorous house ant, Tapinoma sessile (Say)

   Anal opening circular and fringed with hairs (Fig. 6); segment between the thorax and the abdomen distinct (Figs. 7-9).....5

5. Dorsum of thorax step-like in side view; small, about one-eighth inch long, brownish ants (Fig. 7); normally nest under boards, stones, logs and in lawns.....cornfield ants, Lasius alienus americanus Emery, Lasius niger neoniger Emery

   Dorsum of thorax not step-like; larger, from one-quarter to one-half inch long, black ants (Figs. 8, 9); normally nest in dying or wounded trees, stumps, old logs, or in joists and rafters of buildings.....black carpenter ants, Camponotus herculeanus (L.), Camponotus pennsylvanicus (DeGeer)

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[7]For an extended treatment on ants consult; Smith, M. R., 1947, "A generic and subgeneric synopsis of the United States ants, based on the workers", Am. Mid. Nat. 37 (3): 521-647.

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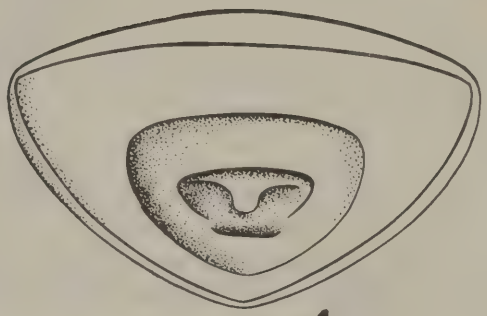

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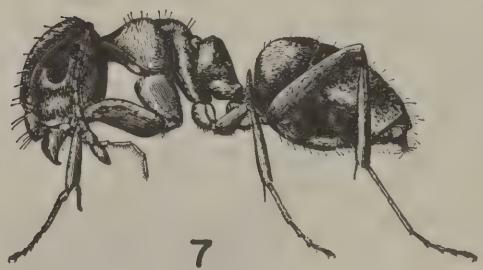

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PUGNACIOUS WASPS IN CANADA (HYMENOPTERA : VESPIDAE)

Most wasps are harmless, but certain kinds will attack and sting man if he molests them or their nests (see Section IV). In all, about 22 different species of pugnacious wasps occur in Canada. The three important genera, i.e., Vespa, Vespula, and Polistes, may be identified by the following characters and habits.

Key to Genera

1. Abdomen bullet-shaped (Fig. 1); nest enclosed in a "paper" sack (Fig. 2).....2

   Abdomen spindle-shaped (Fig. 3); nest not enclosed in a "paper" sack (Fig. 4).....Polistes

2. Large wasps, up to one and one-quarter inches in length; head very large, swollen behind the eyes (Fig. 5); recorded only from the Montreal region.....Vespa
   (Vespa crabro Linnaeus, introduced from Europe, is the only species of this genus that occurs in Canada).

   Smaller wasps, at most three-quarters inch in length (Figs. 6,8); head not unusually large, not swollen behind the eyes (Fig. 7); recorded from almost every region in Canada.....Vespula

FLIES OF MEDICAL IMPORTANCE (DIPTERA)[8]

A considerable number of flies are included among the important insect pests that affect the health and welfare of Canadians. The degree of their importance varies with each species depending upon the seriousness of the harm it brings about. Some species simply annoy us by their presence in dwellings, while others irritate and disgust us by crawling over our bodies, getting into our food, and in general being a nuisance. Bloodsucking species, however, may seriously affect our comfort and health and may pose very serious problems; the same is true of the relatively few species that are associated with disease transmission and myiasis. The following key treats only the families of flies that include medically important species that occur in Canada.

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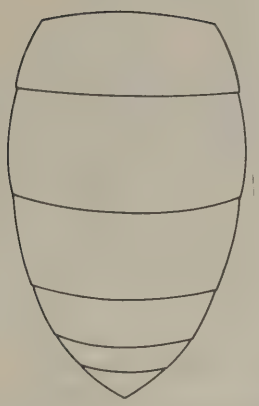
[8]For a comprehensive taxonomic treatment of the order consult: Curran, C.H., 1934, "The families and genera of North American Deptera", 512 pp. Ballou Press, New York.



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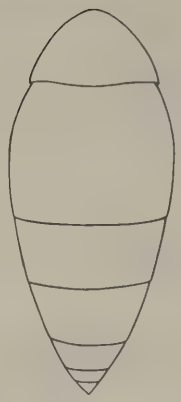

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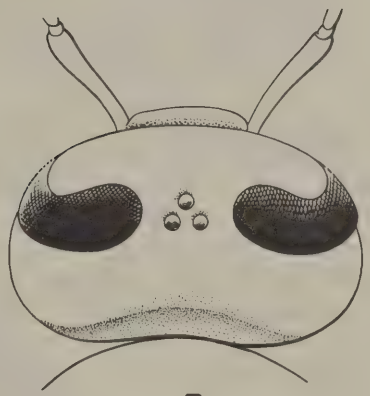

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Key to Families

1. Antennae with ten or more segments (Figs. 1, 2).....2

   Antennae with three segments (Figs. 3-5).....5

2. Antennae short and bare (Fig. 1); wings very broad and clear; posterior veins much weaker than the anterior veins; small (up to one-fourth inch in length), hump-backed biting flies (Fig. 6)..... .....black flies, Family SIMULIIDAE, p.

   Antennae longer, hairy (Fig. 2), especially in the male; wings narrower; posterior veins, as well as anterior ones, strong; otherwise not agreeing with above.....3

3. Six veins reaching the margin of the wing (Fig. 9); small to very small biting flies (Figs. 7,8)..... punkies, sand flies, no-see-ums, Family HELEIDAE (=CERATOPOGONIDAE)

   Ten or more veins reaching the margin of the wing (Fig. 10); larger flies.....4

4. Crossveins near the middle of the wing (Fig. 10); moderately large, one-fourth to one-half inch in length, slender, long-legged, biting flies (Fig. 11) whose flight is accompanied by a high-pitched whine.....mosquitoes, Family CULICIDAE, p.

   Crossveins near the base of the wing (Fig. 12); small, one-eighth to almost one-fourth inch in length, hairy, moth-like, flies (Figs. 13, 14); flight noiseless.....moth flies, Family PSYCHODIDAE

5. Wing with four or five posterior cells (Fig. 16,a).....6

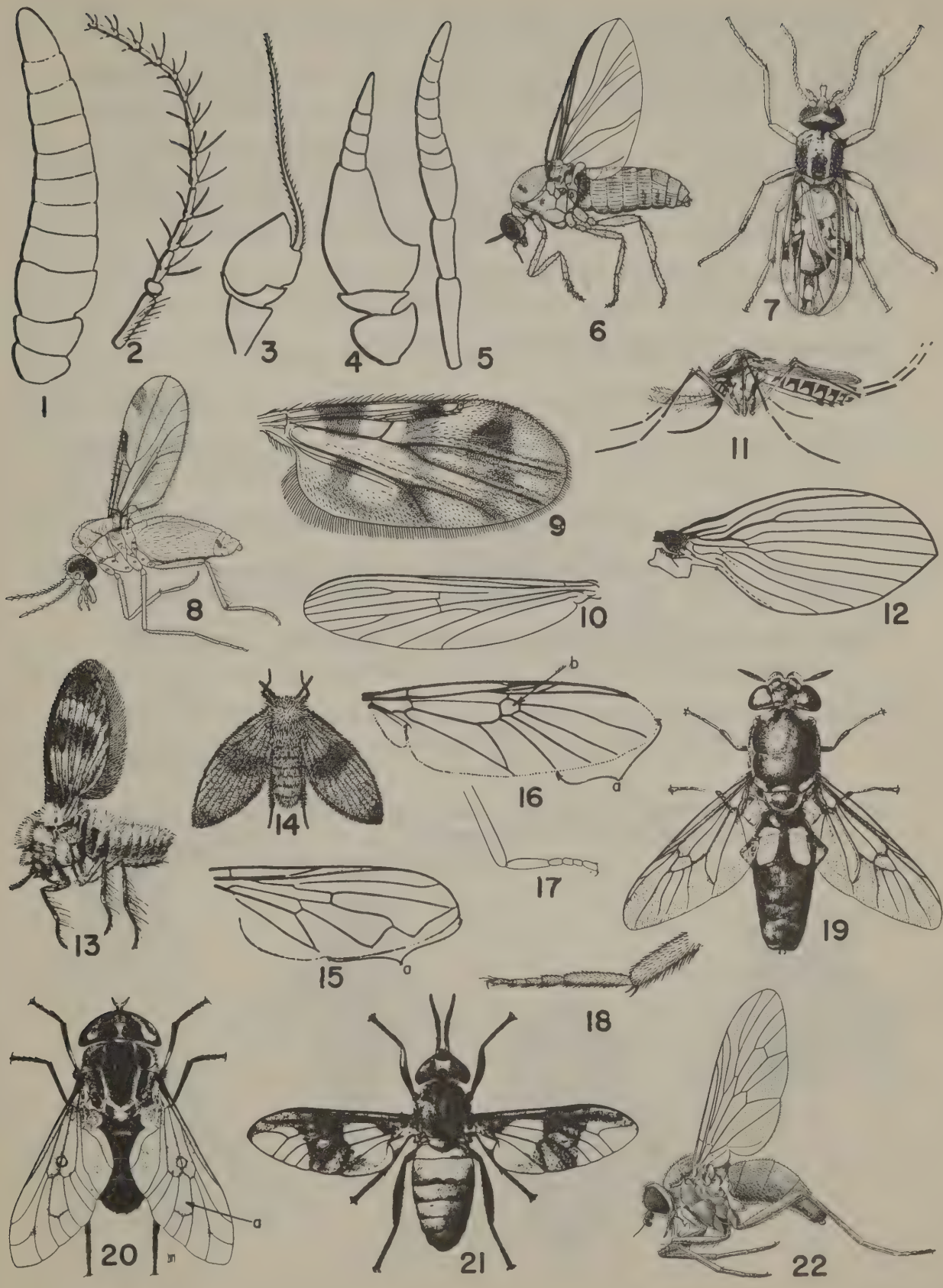
   Wing with not more than three posterior cells (Fig. 15,a).....8

6. Discal cell of wing small (Fig. 16,b); veins crowded toward anterior margin of wing; tibiae without bristles (Fig. 17); non-biting flies (Fig. 19).....soldier flies, Family STRATIOMYIDAE

   Discal cell larger (Fig. 20,a); veins not crowded anteriorly; mid tibia, at least, with bristles (Fig. 18); biting flies.....7

7. Antennae with a style or bristle (Figs. 4,5); stout-bodied flies with broad, flattened abdomens and brightly coloured or banded eyes (Figs. 20,21).....horse and deer flies, Family TABANIDAE, p.

   Antennae with a style or bristle (Fig. 3); abdomen cylindrical, eyes not banded (Fig. 22).....snipe flies, Family RHAGIONIDAE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8. Second antennal segment with a longitudinal cleft (Fig. 23); mesonotal suture usually complete (Fig. 24)..... 9

Second antennal segment without a cleft (Fig. 25); mesonotal suture incomplete (Fig. 26).....16

9. Hypopleuron bare or, at most, with a few scattered hairs (Figs. 27, 28).....muscids, Family MUSCIDAE, p. (This name is used in the wide sense and includes Scatomyzidae and Fanniidae, as well as Muscidae in the strict sense).

Hypopleuron with a row of strong bristles, or a cluster of stiff hairs 10

10. Postscutellum strongly convex (Fig. 27).....11

Postscutellum not evident 14

11. Hypopleuron with a row of strong bristles; antennae usually elongate (Fig. 29) .....parasitic flies, Family TACHINIDAE

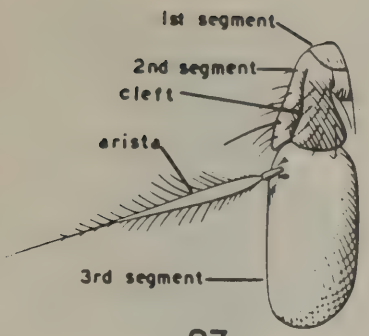
Hypopleuron with a cluster of hairs; antennae extremely short 12

12. Apical cell widely open, third and fourth veins divergent apically (Fig. 30).....horse bot flies, Family GASTEROPHILIDAE

Apical cell closed or strongly narrowed; third and fourth veins convergent apically (Figs. 31, 32).....13

13. Apical cell closed and petiolate; the fourth vein joining the third vein before the wing margin (Fig. 31).....
.....bot flies, Family OESTRIDAE

Apical cell strongly narrowed at the wing margin; the apices of the third and fourth veins close together in the costa (Fig. 32).....
.....warble flies, Family HYPODERMATIDAE



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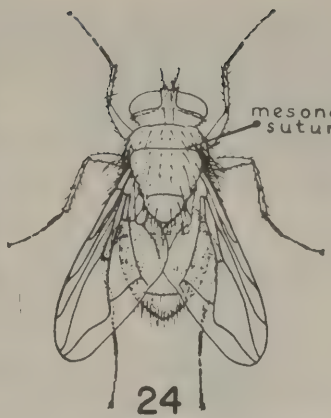

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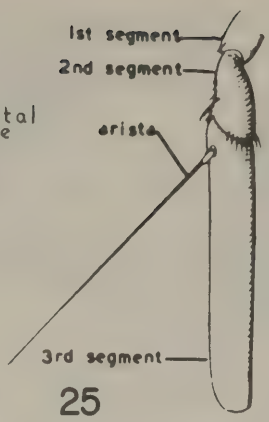

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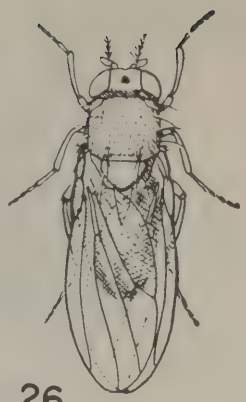

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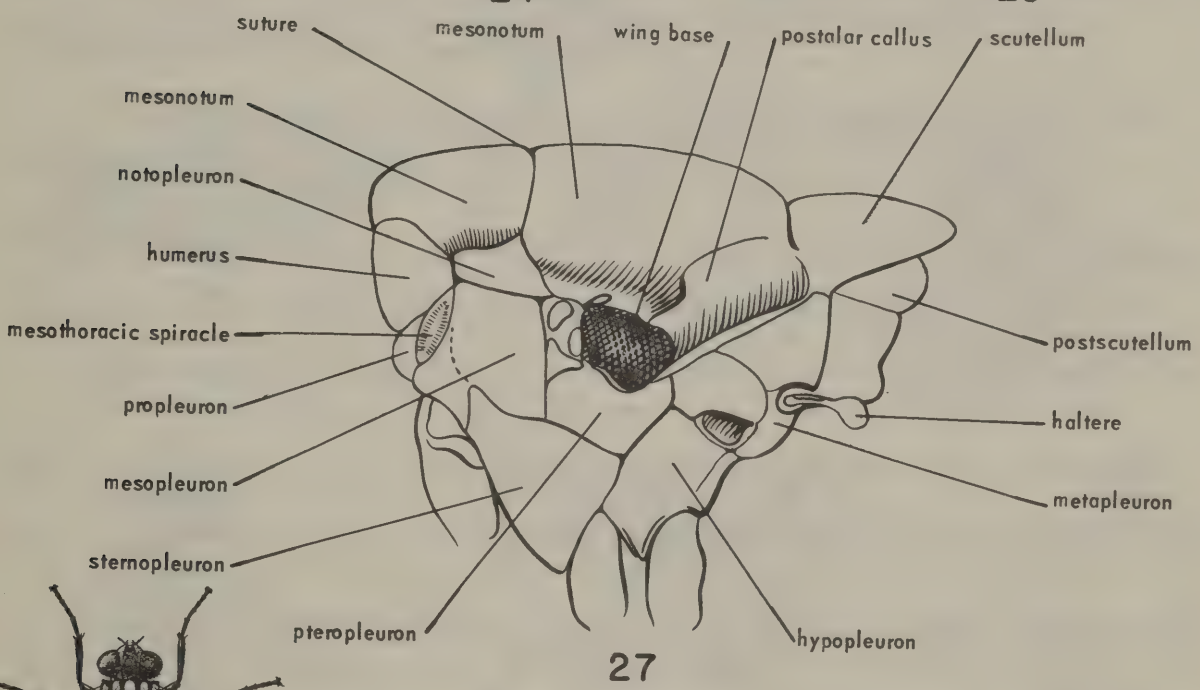

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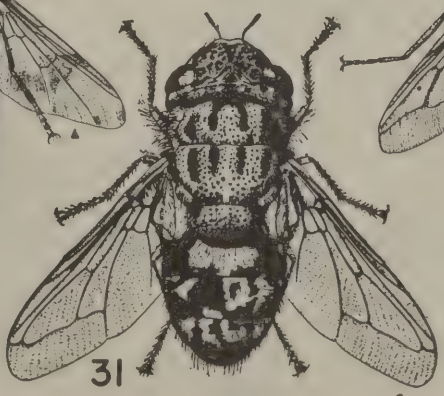

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14. Hypopleuron with a cluster of hairs; thorax with thick pile but without bristles; antennae short; large stout-bodied flies (Figs. 33, 34).... .....robust bot flies, nose bot flies, Family CUTEREBRIDAE

Hypopleuron with a row of bristles; thorax with bristles, rarely with sparse, soft pile 15

15. Two notopleural bristles present; intrapostocular hairs present (Fig. 37,a); sternopleural bristles three, in a triangular arrangement (Figs. 35, 36).....blow flies, Family CALLIPHORIDAE, p.

Often four notopleural bristles present, intrapostocular hairs absent (Fig. 38); sternopleural bristles two or three, when a third is present it is nearly in line with the other two (Fig. 39)..... .....flesh flies, Family SARCOPHAGIDAE

16. Mouthparts inconspicuous, sunk in a very small oval pit; large pilose flies with very short antenna (Figs. 40, 41)..... .....horse bot flies, Family GASTEROPHILIDAE

Mouthparts large, well developed (Fig. 42).....17

17. The first two wing veins behind the wing-tip curved forward, joining with the preceding veins to form closed cells and give the posterior margin of the wing a bordered appearance; a spurious vein present (Fig. 43).....flower flies, Family SYRPHIDAE

Wing veins not so curved; spurious vein absent.....18

18. Posterior veins of wing fine; crossveins absent (Figs. 44, 45)..... .....Family PHORIDAE

Posterior veins of wing as strong as the anterior ones; cross veins present (Figs. 46, 47).....19

19. Anal cell absent (Fig. 46).....20

Anal cell present (Fig. 47,a).....22

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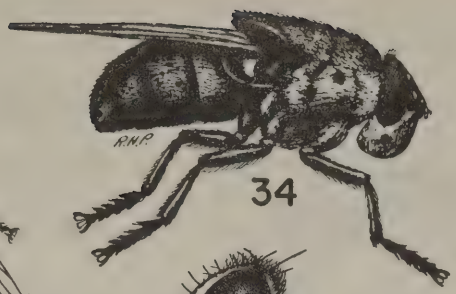

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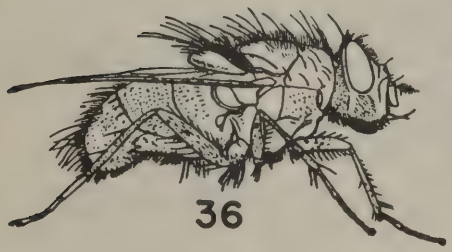

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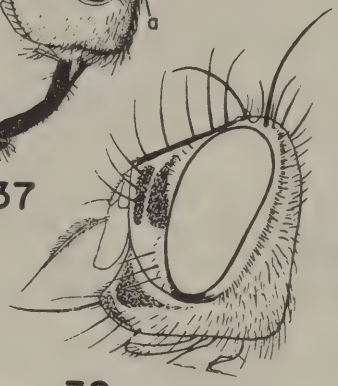

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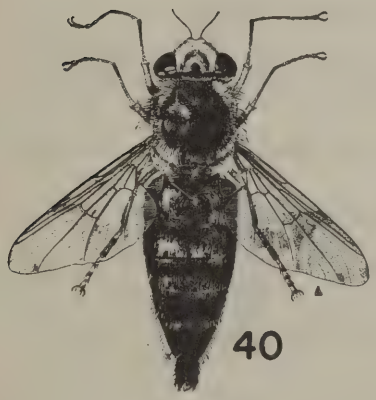

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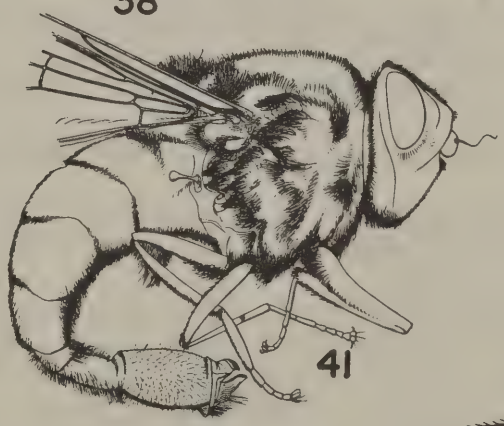

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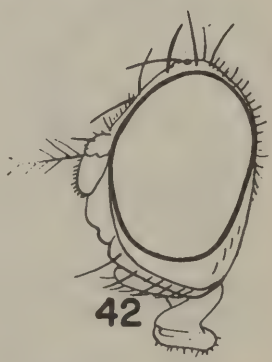

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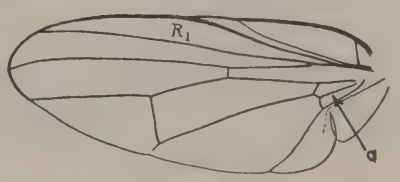

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20. First segment of posterior tarsus short and swollen (Figs. 48, 49).....Family BORBORIDAE

First segment of posterior tarsus not short and swollen.....21

21. Fourth vein of wing with a short bend near the middle (Fig. 50,a); postocellar bristles convergent or absent (Fig. 50)..... .....fruit flies, eye gnats, Family CHLOROPIDAE

Fourth vein of wing straight; postocellar bristles divergent (Fig. 51).....shore flies, Family EPHYDRIDAE

22. Halteres always black (Fig. 53,a); wings clear, apex of anal cell square (Fig. 52,a); female with a stilletto-like ovipositor (Fig. 53,b); shining, blue-black flies.....Family LONCHAEIDAE

Halteres usually whitish, if black, apex of anal cell is drawn out to a sharp point.....23

23. Oral vibrissae absent; wings usually with bands or spots (Figs. 54, 55), apex of anal cell often drawn out to a point (Fig. 55,a); ovipositor long, stilletto-like (Fig. 55,b)..... .....Families OTITIDAE and TRYPETIDAE

Oral vibrissae present (Fig. 59,a).....24

24. Arista plumose (Fig. 57,a); yellowish or reddish-brown flies, (Figs. 56,57)..... .....fruit, vinegar or pomace flies, Family DROSOPHILIDAE, p.

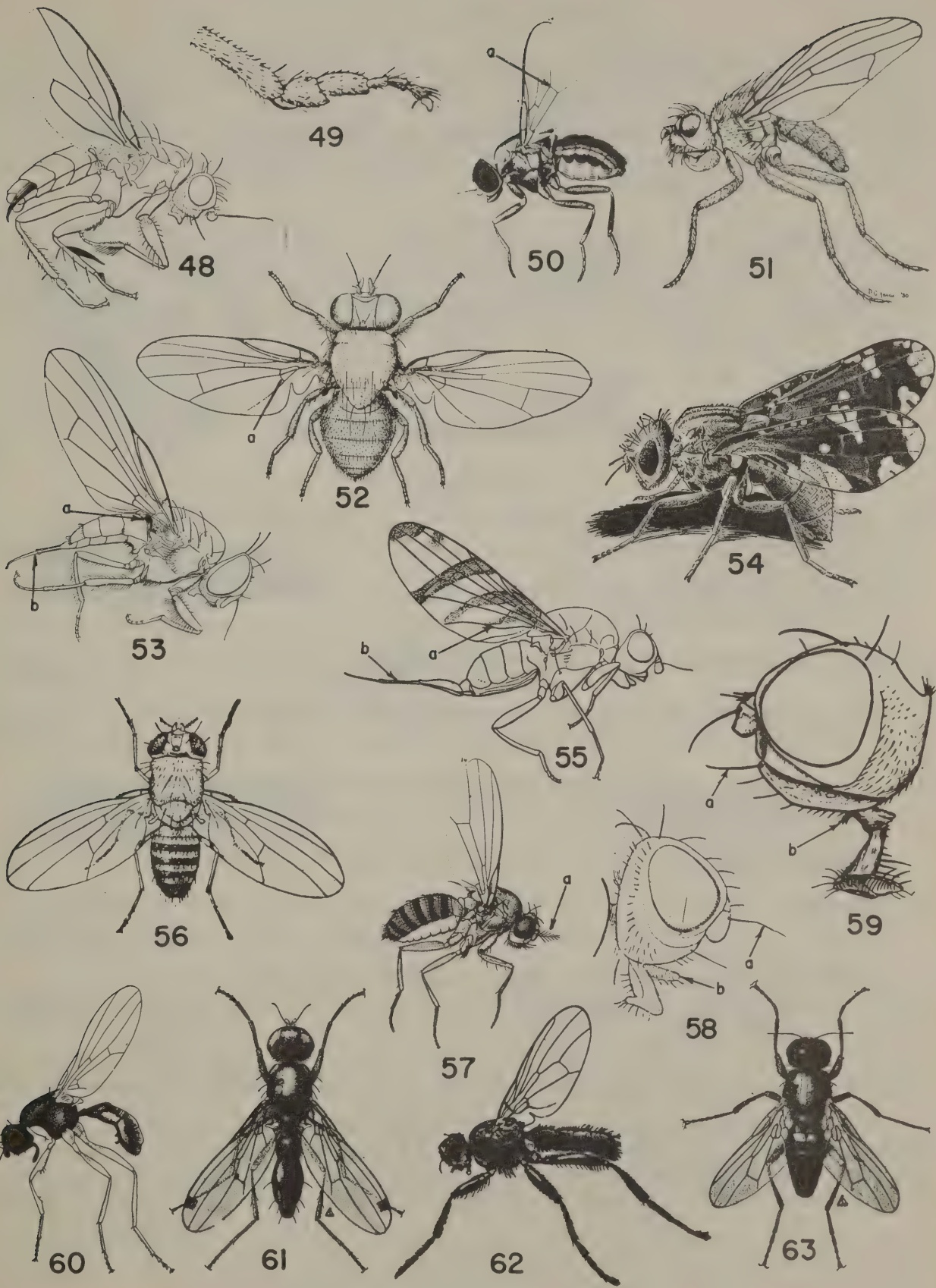
Arista bare (Fig. 58,a); shining black flies.....25

25. Abdomen constricted basally, wing often with a spot near the apex (Figs. 60,61); palpi vestigial (Fig. 59,b).....Family SEPSIDAE

Abdomen broad basally, wing rarely with an apical spot (Figs. 62, 63); palpi well-developed (Fig. 58,b).....Family PIOPHILIDAE

A. BITING FLIES OF CANADA

The biting flies (see Section I) that occur in Canada represent six families, i.e., Culicidae, the mosquitoes; Heliidae (=Ceratopogonidae), the sandflies (most species that bite belong to the genus Culicoides); Simuliidae, the black flies; Tabanidae, the horse, deer and breeze flies; Rhagionidae, the snipe flies (a few members of the genus Symphoromyia, only, bite man); and Muscidae, the house fly family (the only fly of this family that bites man is Stomoxys calcitrans (L.), the stable fly). The foregoing "Key to Families" will serve to segregate these families. Culicidae, Simuliidae and Tabanidae are treated in more detail below.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Family Culicidae (Mosquitoes)[9]

Mosquitoes may be distinguished from many superficially similar but non-biting flies by the presence of a long slender proboscis and abundant fine scales on the wings. Male mosquitoes do not bite; their antennae are densely covered with long fine hairs so that they appear to carry two brushes on the head. Female mosquitoes have only very short, sparse antennal hairs so that the antennae appear threadlike.

Mosquito larvae are aquatic. The thorax is conspicuously broader than the head or abdomen; the last segment is attached at an angle to the preceding segments and bears four colourless tubular processes (and gills) and a dense brush of hairs. In all mosquitoes except those of the genus Anopheles the end of the abdomen also bears a deeply pigmented, tapering air tube.

Keys to Important Mosquito Genera

1. Adult Females

1. Palpus about as long as proboscis (Fig. 1); body held at angle to skin surface when biting.....Anopheles

   Palpus much shorter than proboscis (Fig. 2); body held parallel to skin surface when biting.....2

2. Wing scales broad (Fig. 3); proboscis with a pale band (Fig. 4)..Mansonia

   Wing scales narrow (Fig. 6); proboscis almost always entirely dark (Fig. 5).....3

3. End of abdomen pointed (Fig. 7); postspiracular bristles present Figs. 13, 9).....Aedes

   End of abdomen blunt (Fig. 8); postspiracular bristles absent.....4

4. Spiracular bristles present (Fig. 13); large, heavy-bodied mosquitoes often with spotted wings (Fig. 10).....Culiseta

   Spiracular bristles absent; small, slender mosquitoes with unspotted wings (Figs. 11, 12).....Culex

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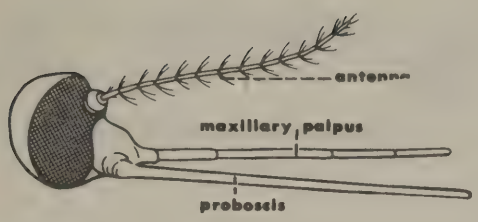
[9]For a monographic treatment of the family Culicidae in North America consult: Matheson, R., 1944 "Handbook of the mosquitoes of North America", 314 pp. Comstock Publishing Co. Inc., Ithaca, N.Y., or Carpenter, S. J. and W. J. LaCasse, 1955, "Mosquitoes of North America", Univ. of California Press.



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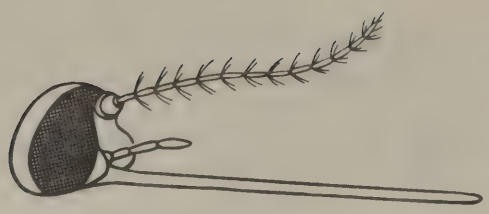

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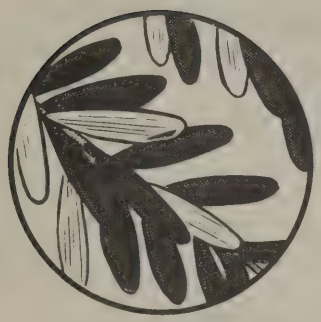

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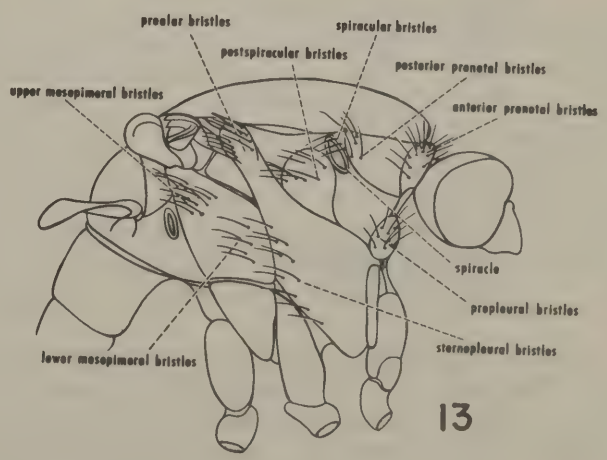

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2. Larvae

1. End of abdomen without air tube; larva, when at water surface, with body parallel to surface (Figs. 14, 16).....Anopheles

   End of abdomen with air tube; larva, when at surface, with body held at angle to surface (Fig. 15).....2

2. Air tube sharply pointed at apex, with teeth along one side of apical half (Fig. 17).....Mansonia

   Air tube not pointed, without teeth on apical half 3

3. Air tube with a pair of hair tufts near the base (Fig. 18), sometimes also with additional tufts on apical half.....Culiseta

   Air tube without a pair of tufts near the base but with one or more pairs of tufts on apical half (Figs. 19, 20).....4

4. Air tube with several pairs of hair tufts along lower margin (Fig. 20).....Culex

   Air tube with a single pair of tufts along lower margin, (Figs. 19, 21).....Aedes

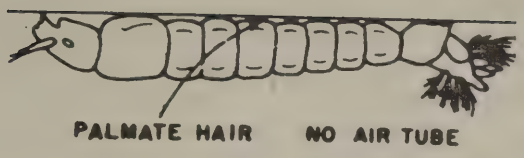
Family Simuliidae (Black flies)

The adults (see Section I) are small (2-3 mm. in length), robust, blackish, hump-backed flies with short cylindrical antennae and broad transparent wings, the latter with strong veins only near the anterior border. Several of the most aggressive species have the front pair of legs conspicuously marked with white. These markings are clearly seen as the flies crawl over the exposed skin and have earned for them the nickname "white-stocking".

Black flies breed in running water. The larvae congregate on rocks, weeds or debris in places where the current is swiftest.

The full-grown larva is about a centimeter long and less than two millimeters thick. The body is cylindrical and light greenish-brown or grey in colour. The head is well developed and dark brown in colour; two fan-like organs (mouth-fans) protrude from it with which the larva dredges minute food particles out of the water. Its blunt posterior end is furnished with a ring of minute hooks by means of which it clings to strands of silk that it attaches to rocks and other objects. When ready to pupate, the larva usually spins a silken cocoon that may be a simple loosely-woven sleeve or a more elaborate structure with a circular opening usually facing downstream. From this opening the characteristic "respiratory filaments" of the pupa protrude.

In the following keys, characters that can be readily seen under a low-power stereoscopic microscope have been utilized as much as possible. For this reason a few characters that are commonly used for separating the genera have not been stressed. No comprehensive keys to larvae and pupae of the North American species have been published. The keys below will serve to place the



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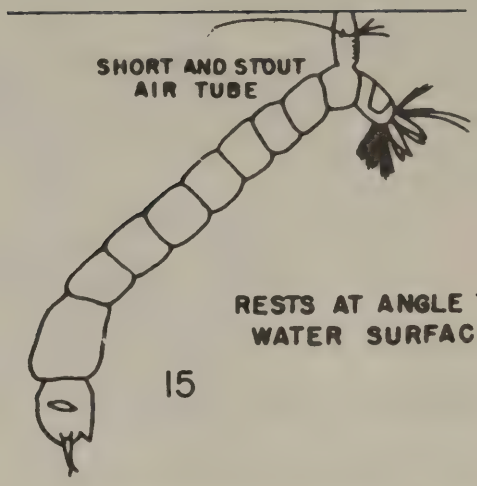

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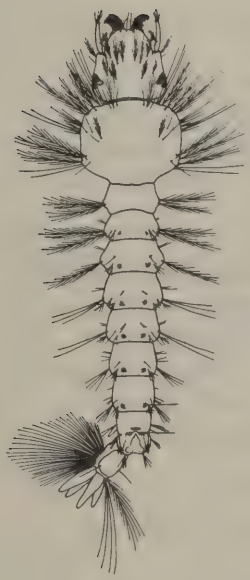

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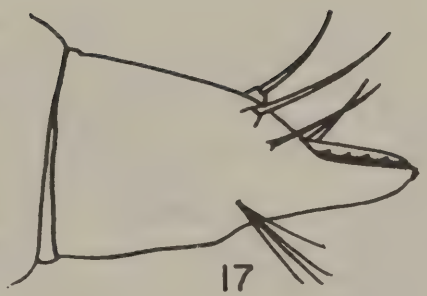

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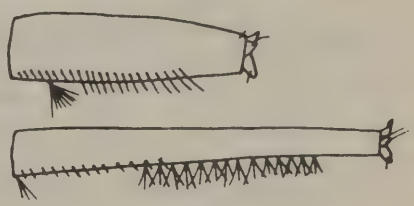
Air tube with a basal pair of hair tufts and a row of tufts or straight hairs



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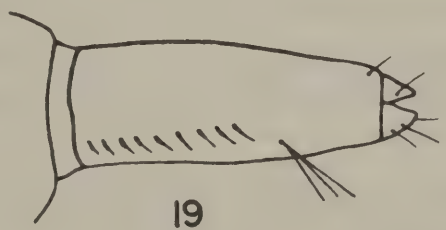

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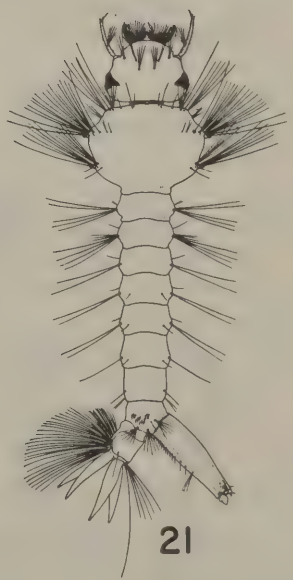

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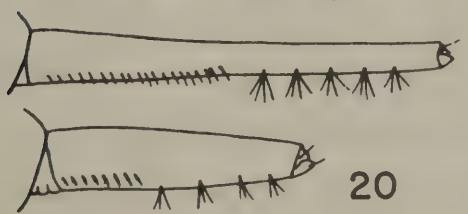
Air tube without a basal pair of tufts although several other pairs of tufts or hairs are present



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common pest species found in Canada in their proper genera. For more complete treatments of the group consult: Sommerman, K. M., 1953, "Identification of Alaskan black fly larvae, (Diptera, Simuliidae)", Proc. Ent. Soc. Wash. 55(5): 258-273; Stone, A., 1952, "The Simuliidae of Alaska (Diptera)", Proc. Ent. Soc. Wash. 54(2): 69-96; Twinn, C. R., 1936, "The black flies of eastern Canada (Simuliidae; Diptera)", Can. Journ. Res., D, 14: 97-150; Stone, A. and H. A. Jamnback, 1955, "The Black flies of New York State", N. Y. St. Mus. Bull. No. 349, Albany, N. Y.

Keys to Important Genera

1. Adult Females

1. Membrane of the mesopleura with a tuft of hairs (Fig. 1).....Cnephia

   Membrane of the mesopleura bare.....2

2. Length of the basal portion of the radius (Fig. 2,a) equal to much more than one-third the remaining distance to the apex of the wing (Fig. 2,b). Knobs of the halteres (Fig. 1) brown (occasionally orange), not noticeably paler than the stalks. Second segment of hind tarsus without a notch in the dorsal surface (Fig. 4).....3

   Length of the basal portion of the radius (Fig. 3,a) equal to much less than one-third the remaining distance to the apex of the wing (Fig. 3,b). Knobs of the halteres (Fig. 1) pale lemon-yellow or white, contrasting with the dark stalks. Second segment of the hind tarsus with a deep notch in the dorsal surface (Fig. 5) (sometimes difficult to see unless the hairs are removed).....4

3. Costa with both spines and hairs (Fig. 3). Radial sector not forked or occasionally obscurely forked at the tip, its upper surface almost bare (Fig.3).....Cnephia

   Costa with hairs only (Fig. 2). Radial sector forked, the upper surface of the anterior branch almost bare, that of the posterior branch thickly haired (Fig. 2)[10] .....Prosimulium

4. Basal portion of the radius bare (Fig. 3). Legs usually partly pale yellow (Figs. 6,7). Front tibia often bright silvery-white on anterior surface (Fig. 7) (visible with naked eye).....Simulium

   Basal portion of the radius haired (Fig. 2). Legs usually all black. Front tibia usually without a conspicuous silvery-white patch, although often with thick white pubescence.....Eusimulium

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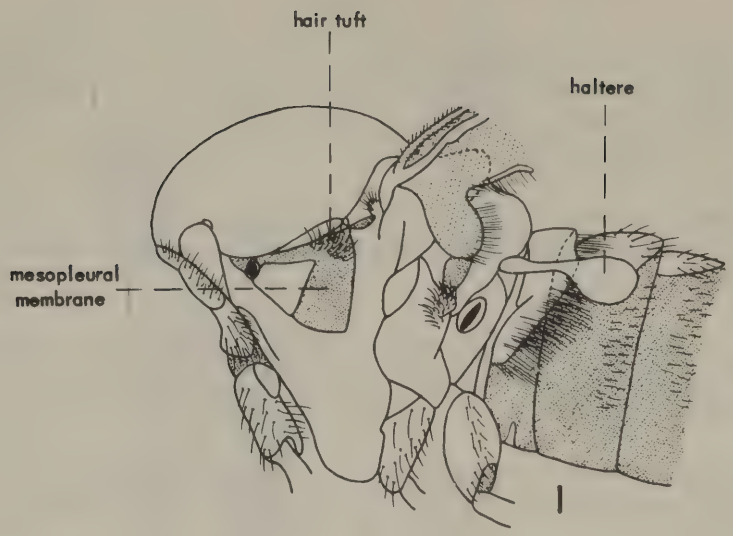
The two branches of the radial sector lie close together. The anterior branch is best seen from below. Its under surface is then seen to be thickly haired, like the upper surface of the posterior branch.


hair tuft
haltere
mesopleural membrane

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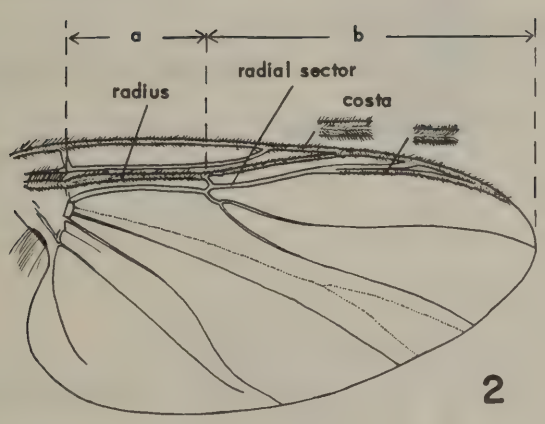
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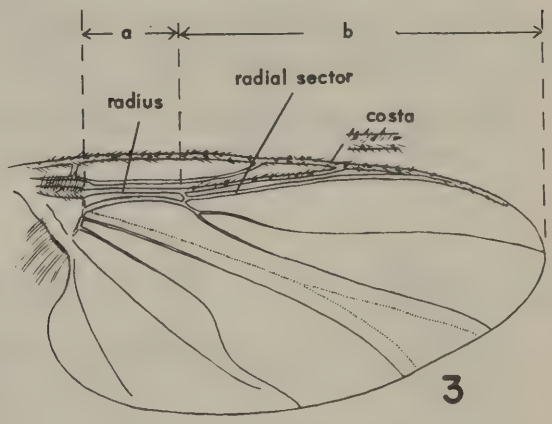
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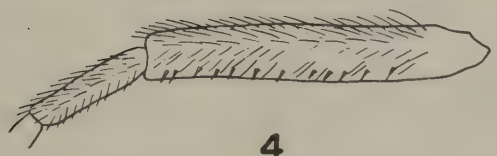

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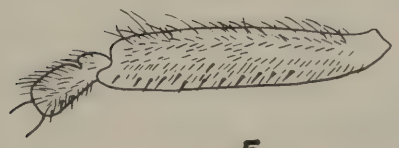

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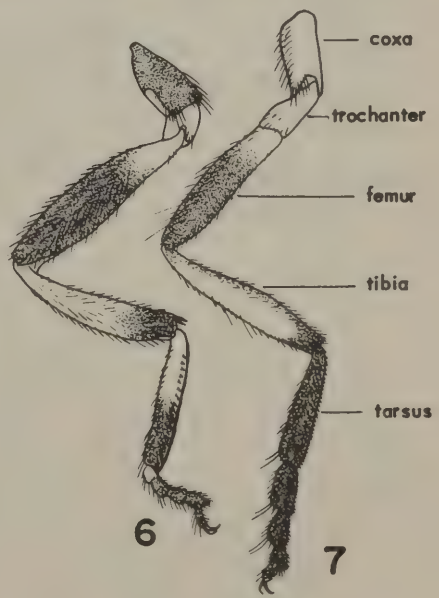

coxa
trochanter
femur
tibia
tarsus

6 7

2. Pupae

1. Apex of abdomen with two strong hooks (Fig. 8). Pupa sometimes naked, but if enclosed within a cocoon, the latter is loosely woven, sleeve-like in form, with an untidy opening; walls sometimes with fine silt granules (Fig. 9).....2

   Apex of abdomen without strong hooks. Pupa always in a cocoon which is closely woven with a reinforced or ornamented opening (Figs. 10, 12).....3

2. Respiratory organ with 12 filaments arising from two long divergent stalks (Fig. 11) or with about 30 filaments arising from an enlarged bulbous base (Fig. 14).....*Cnephia*

   Respiratory organ with a cluster of 14 to 16 filaments arising from three short stalks (Fig. 13). If with more filaments, the base not bulbous.....*Prosimulium*

3. Cocoon boot-shaped; the anterior opening raised from the substrate (Fig. 10).....*Simulium* and *Cnephia*

   Cocoon slipper-shaped; the anterior opening in contact with the substrate (Fig. 12).....*Simulium* and *Eusimulium*

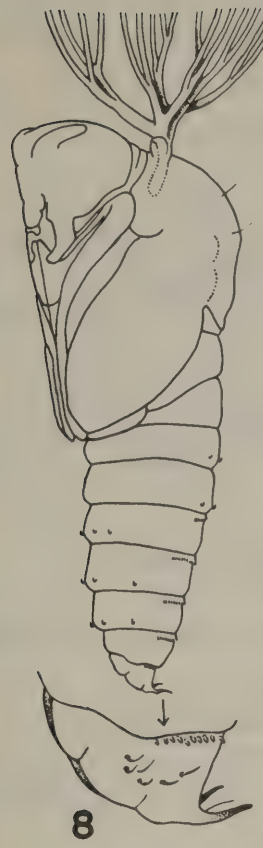
3. Late-stage Larvae

1. Abdomen with two conspicuous conical papillae near apex on ventral side (Fig. 17).....*Eusimulium*

   Abdomen without such papillae.....2

2. Gular cleft (Fig. 15) (on ventral side of head capsule), very long and narrow, extending anteriorly beyond base of submentum (Fig. 16).....*Cnephia*

   Gular cleft of different shape and seldom extending to base of submentum.....3



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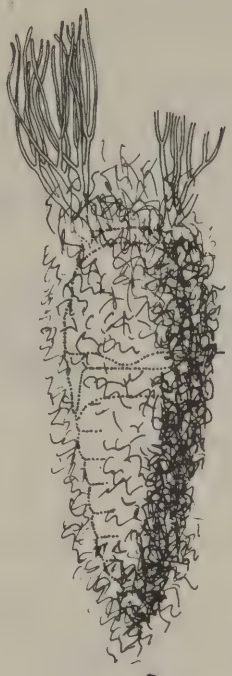

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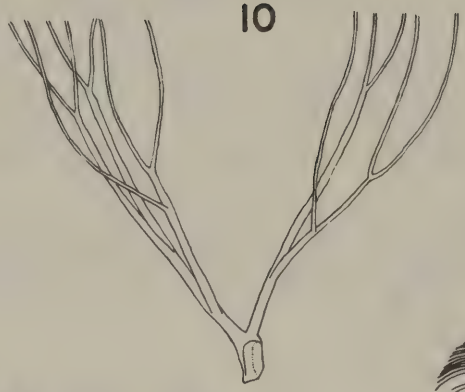

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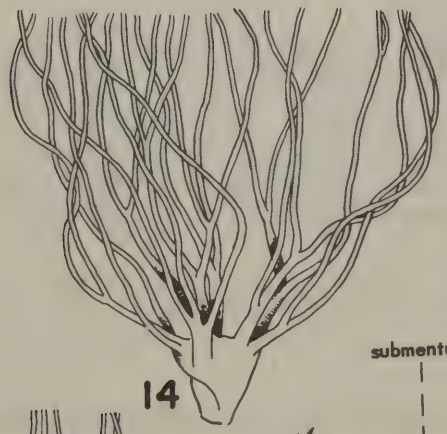

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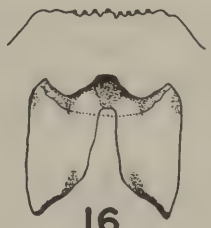

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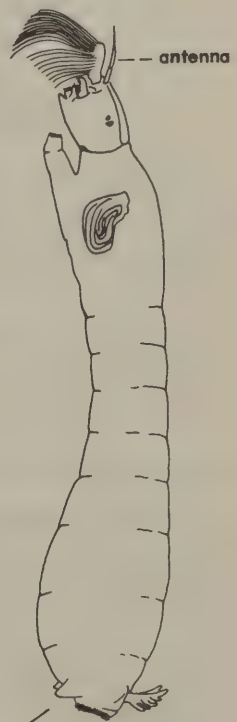
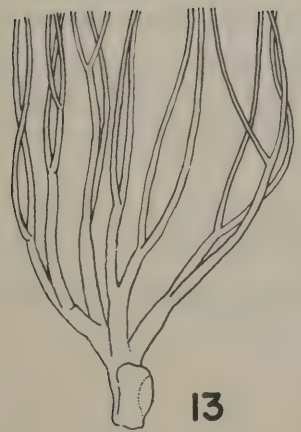


antenna



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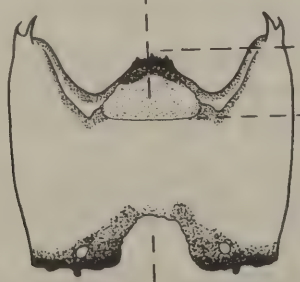

submentum

tip

base

gular cleft

15

17

3. Gular cleft usually extending at least one-half the distance to tip of submentum; tapered anteriorly; often bulb-shaped (Fig. 19)....Simulium

Gular cleft much shorter, not extending more than one-third the distance to tip of submentum (Figs. 20-22).....4

4. Teeth of submentum long and strong, together forming an apical process with parallel or slightly divergent sides; a central tooth, long clearly isolated and trifid, usually present (Fig. 20). Gular cleft much broader than long, bluntly tapered, rounded or sub-truncate anteriorly (Fig. 20).....Prosimulium

Teeth of submentum much smaller so that the submentum converges more or less evenly to its apex. A central tooth differentiated but usually not clearly isolated (Figs. 18, 21, 22). Gular cleft usually at least as long as broad (Figs. 18, 21, 22).....5

5. Gular cleft extending about one-third the distance to apex of submentum; as broad as long, rounded anteriorly (Fig. 18). Abdomen constricted on basal half, bulbous on apical half (Fig. 24). Antenna with two pale rings near middle (Fig. 23)....Simulium vittatum

Gular cleft usually very short; tapered anteriorly (Fig. 22); if longer (Fig. 21), as described above, then abdomen evenly expanded from base to apex (Fig. 25). Antenna without pale rings..... ..... Cnephia

Family Tabanidae (Horse Flies, Deer Flies, Breeze Flies)

There are more than 125 species of tabanids, belonging to nine or ten genera[11] in Canada. Species of the genera Tabanus (horse flies, moose flies or bull dogs), Chrysops (deer flies), and Haematopota (breeze flies or clegs) are known to attack men and animals (see Section I).

All are robust flies with brightly coloured eyes and broad, flat, abdomens. Only the females suck blood; the males are relatively rare and are not attracted to man or animals.

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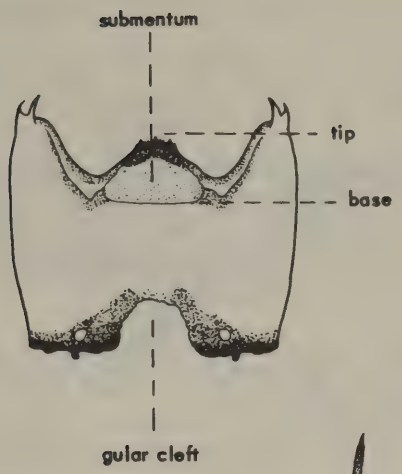
[11]For extensive taxonomic treatments in this family in North America see:
Philip, C. B., 1947, "A catalogue of the blood-sucking fly family Tabanidae (Horseflies and Deerflies) of the Nearctic Region north of Mexico." Am. Mid. Nat. 37(2): 257-324.
Stone, A., 1938, "The Horseflies of the subfamily Tabaninae of the Nearctic Region." U.S.D.A. Misc. Pub. 305. 172 pp. U.S. Government Printing Office, Washington.
Brennan, J. M., 1935, "The Pangoniinae of Nearctic America (Diptera: Tabanidae)" Univ. Kans. Sci. Bull. 22(13): 249-401.



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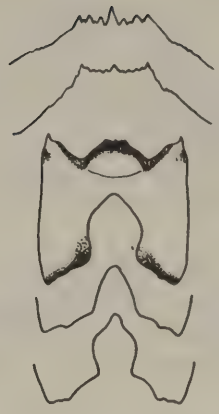

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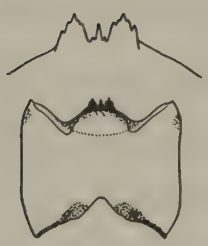

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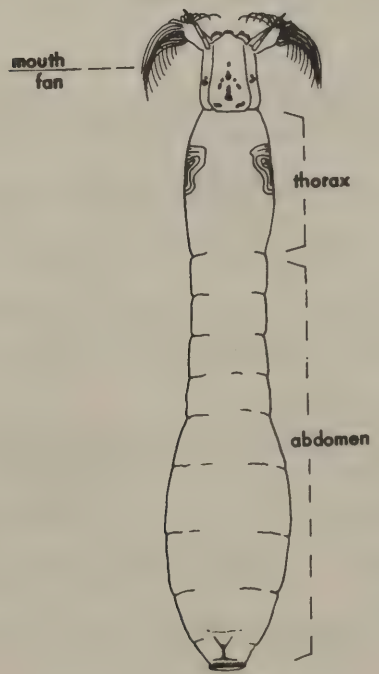

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Key to Adult Females of Important Genera

1. Hind tibia with a pair of spurs at apex (Fig. 2); first and second segments of antenna elongate (Fig. 3); wings usually with dark bands (Fig. 1).....deer flies, Chrysops spp.

   Hind tibia without a pair of spurs at apex; second antennal segment short (Figs. 4,5); wings sometimes pictured but not banded.....2

2. First antennal segment considerably longer than thick, third segment without a dorsal projection (Fig. 4); wings grey, variously "speckled" with white (Fig. 5).....
   .....breeze flies or clegs, Haemotopota spp.
   (H. americana O.S., only, is known to occur in Canada).

   First antennal segment scarcely longer than thick, third segment with a dorsal projection (Fig. 6): wings usually clear, sometimes with dark spots, or uniformly smoky-coloured (Fig. 7).....
   .....horse flies, moose flies or bull dogs, Tabanus spp.

B. NON-BITING HOUSEHOLD FLIES OF CANADA

Less than a dozen kinds of flies are encountered with any frequency in dwellings (see SectionV). Most of these breed outside in dung and filth and enter houses for shelter or food; some, however, breed in meat and other foodstuffs and are troublesome on that account. The following key will serve to separate the adults of most of the common pest species.

Key to Some Common Domestic Flies
(Families Muscidae, Calliphoridae, and Drosophilidae)

1. Fourth vein curved or angled (Figs. 8,a, 9,a).....2

   Fourth vein straight (Fig. 10,a).....8

2. Fourth vein gently curved (Fig. 8,a); tip of scutellum pale; dull grey flies (Fig. 11) attracted to decaying vegetable matter.....
   .....Muscina spp.

   Fourth vein strongly angled (Fig. 9,a); tip of scutellum dark.....4

3. Legs black.....Muscina assimilis (Fall.)

   Legs yellowish-orange.....false stable fly, Muscina stabulans (Fall.)

4. Body dull greyish or brownish-black; pests in dwellings, barns, etc.....5

   Body at least partly shining blue or green; pests about dumps, meat and decaying animal matter.....6

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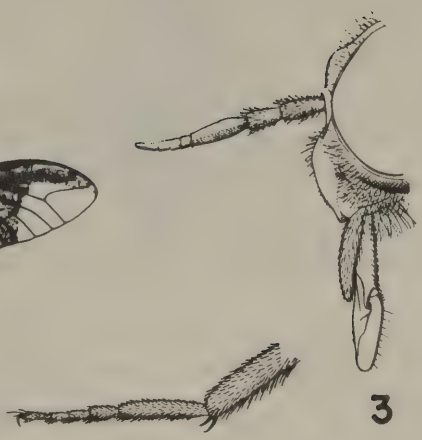

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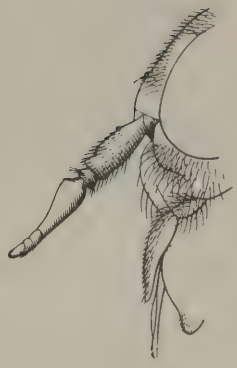

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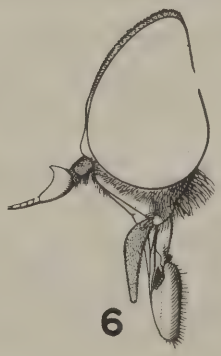

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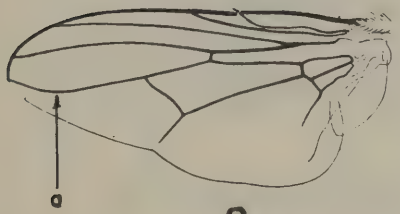

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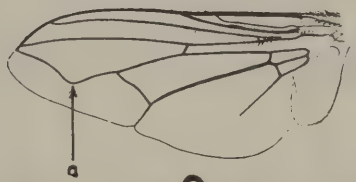

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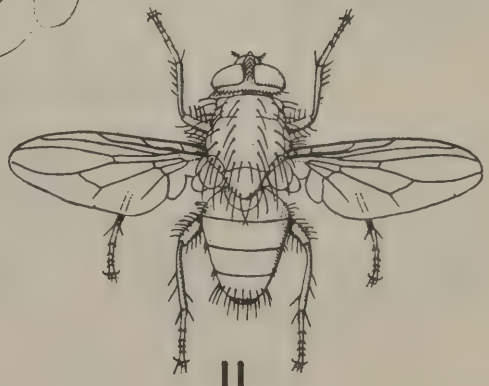

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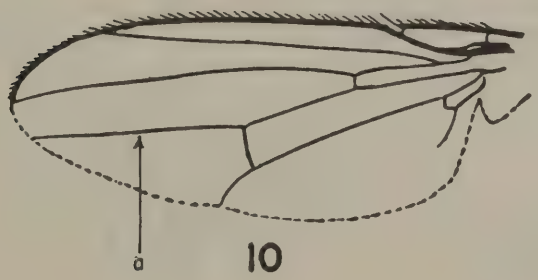

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5. Thorax with four dark stripes; all hairs and bristles black (Fig. 12).....house fly, Musca domestica L.

Thorax without stripes; with many soft, silky, golden hairs in addition to stiff black bristles; often found in garret windows (Fig. 13).....cluster fly, Pollenia rudis (F.)

6. Lower squamal lobe (Fig. 15) pilose above; robust species with dull-greyish thorax and shining-blue abdomen (Fig. 14).....
.....blue bottle flies, Calliphora spp.

Lower squamal lobe (Fig. 15) bare above; smaller flies with both thorax and abdomen shining-green or bluish-green.....7

7. Subcostal sclerite (Fig. 16) (on the under side of base of wing) with wiry bristles; (Fig. 17).....Lucilia illustris (M.)

Subcostal sclerite (Fig. 16) with only soft short pubescence; (Fig. 18); sometimes causing myiasis in animals and man.....
.....green bottle flies, Phaenicia spp.

8. Antennal arista plumose (Fig. 19); small brownish or yellowish flies (Fig. 20); attracted to vegetables, fruit, and garbage.....
.....fruit flies, vinegar flies or pomace flies, Drosophila spp.

Antennal arista bare (Fig. 22); larger greyish flies.....9

9. Thorax dull greyish-brown with an evident darker brown central stripe; sides of abdomen, at base, usually yellowish (Fig. 21); middle leg of male normal (Fig. 23); often found in dwellings.....
.....little house fly, Fannia canicularis (L.)

Thorax and abdomen uniformly greyish-black; middle tibia of male with a deformed tubercle (Fig. 24); often found in latrines.....
.....latrine fly, Fannia scalaris (F.)

FLEAS OF ECONOMIC IMPORTANCE IN CANADA (SIPHONAPTERA)

Fleas (see Section IV), like lice, are parasites of warm blooded creatures. Unlike lice, however, they are blood-feeders during their adult stage only; their immature stages are passed in moist soil, nesting debris, or dirt.

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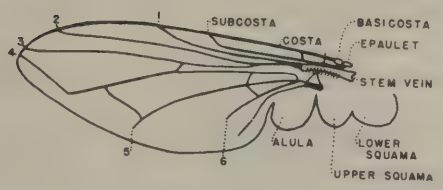

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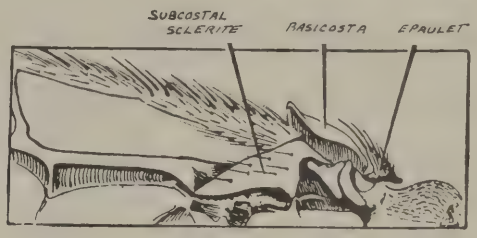

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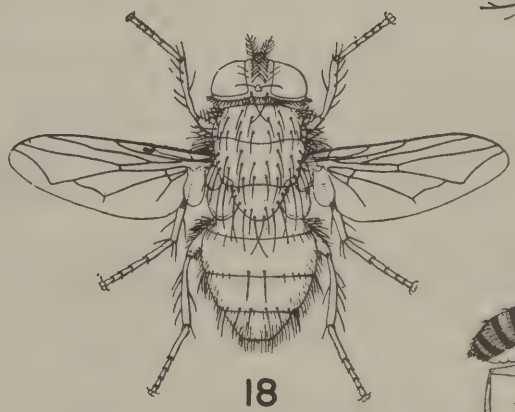

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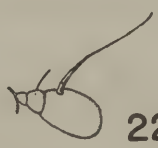

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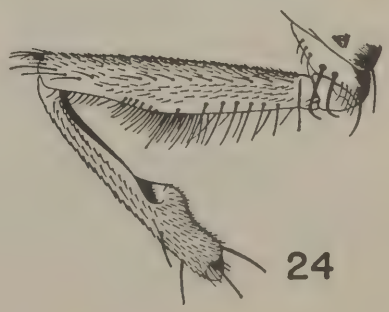

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About 150 species, belonging to five families occur in Canada. Of these, five species are believed to have been introduced from Europe or Asia, being common parasites of man and domestic animals, and are now almost cosmopolitan in distribution. Because of their economic importance, these species have been widely discussed in medical and entomological literature. These five species and an additional native species are treated below.[12]

Key to Fleas that are Pests of Man and Domestic Animals

1. With combs (Fig. 1).....2

   Without combs (Fig. 10).....5

2. Combs on head and thorax (Fig. 1).....3

   Combs on thorax only (Fig. 2).....4

3. Head broadly rounded (Fig. 3); first genal spine (Fig. 3,a) noticeably shorter than the second (Fig. 3,b).....
   .....dog flea, Ctenocephalides canis (Curt.)

   Head somewhat pointed; first genal spine not noticeably shorter than the second (Fig. 4).....cat flea, Ctenocephalides felis (Bouche)

4. Occurring in poultry houses in Saskatchewan and eastward; male with movable process of clasper (Fig. 5,a) about twice as long as fixed process (Fig. 5,b); female with head of spermatheca (Fig. 6,a) almost twice as wide as the tail (Fig. 6,b).....
   .....European chicken flea, Ceratophyllus gallinae (Sehr.)

   Occurring in poultry houses in Alberta and westward; male with movable process of clasper less than twice as long as fixed process (Fig. 7); female with head of spermatheca less than twice as wide as the tail (Fig. 8).....Western chicken flea, Ceratophyllus niger Fox

5. Mesothorax with pleural rod (Fig. 9,a, 10).....
   .....Oriental rat flea, Xenopsylla cheopis (Rothsch.)

   Mesothorax without pleural rod (Fig. 11,a, 12).....
   .....human flea, Pulex irritans L.

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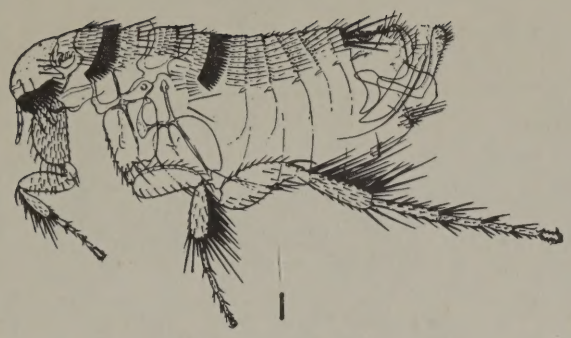
[12] For a monographic treatment of the order in Canada consult: Holland, G. P., 1949, "The Siphonaptera of Canada." Dom. of Can. Dept. of Agr. Tech. Bull. 70: 306 pp.



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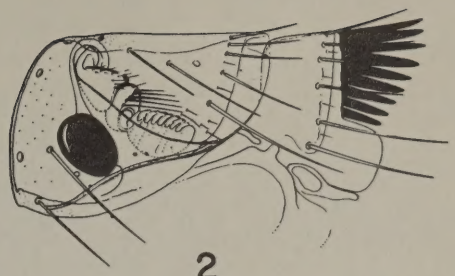

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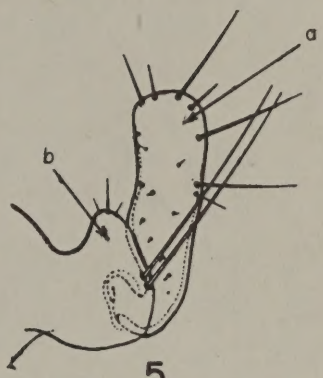

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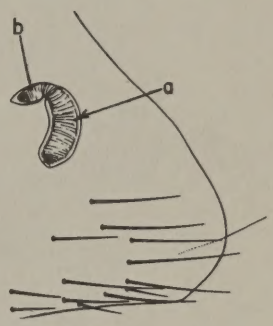

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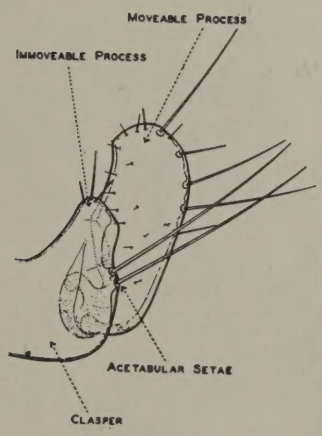

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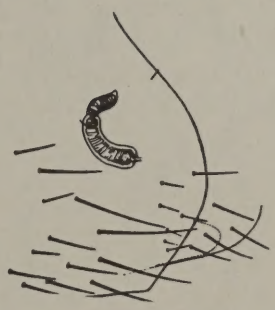

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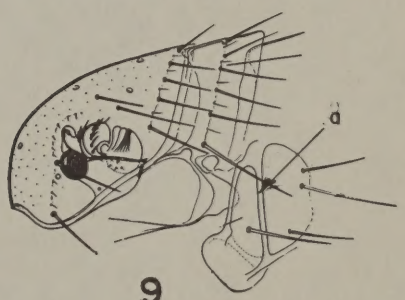

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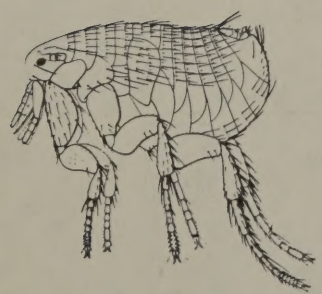

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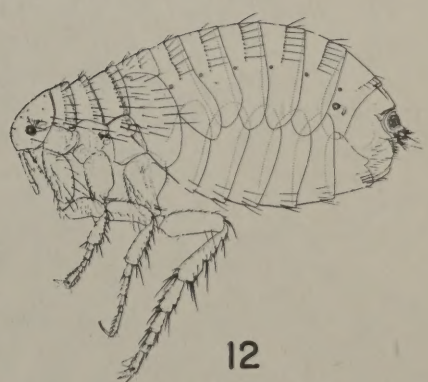

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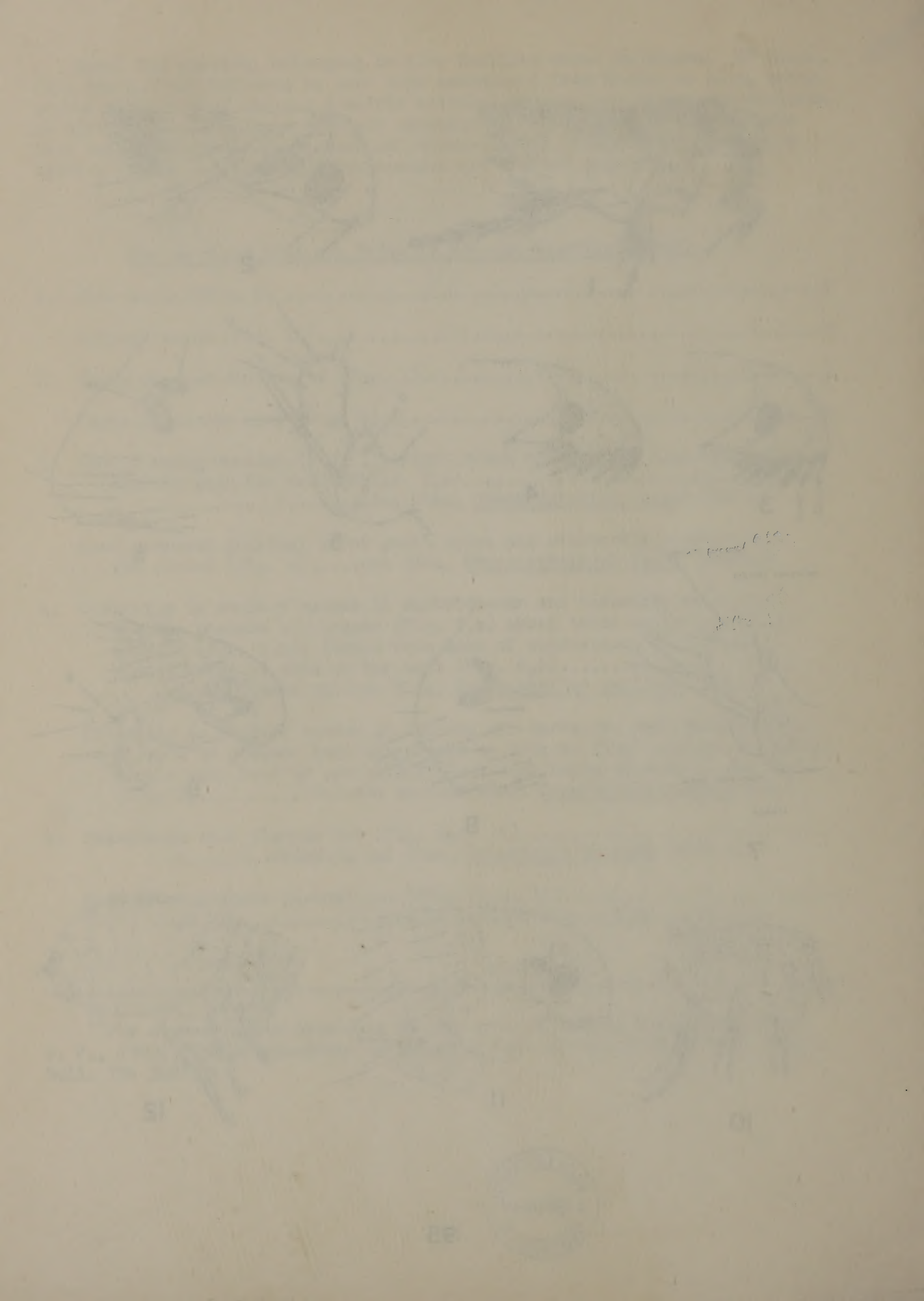

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